WORLD PETROLEUM

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APRIL 1957

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Protection is our business

If you are looking for oil, you are looking for pressure – preferably high pressure. High pressure or low, Cameron controls offer the finest protection available in the world today. Our development of the first successful Blowout Preventer set a standard and started a trend in specialized products to meet every demand for the control of the destructive pressures encountered in drilling and production. Protect your rig investment – protect your reserves and protect your personnel with the best equipment available – Cameron, of course.

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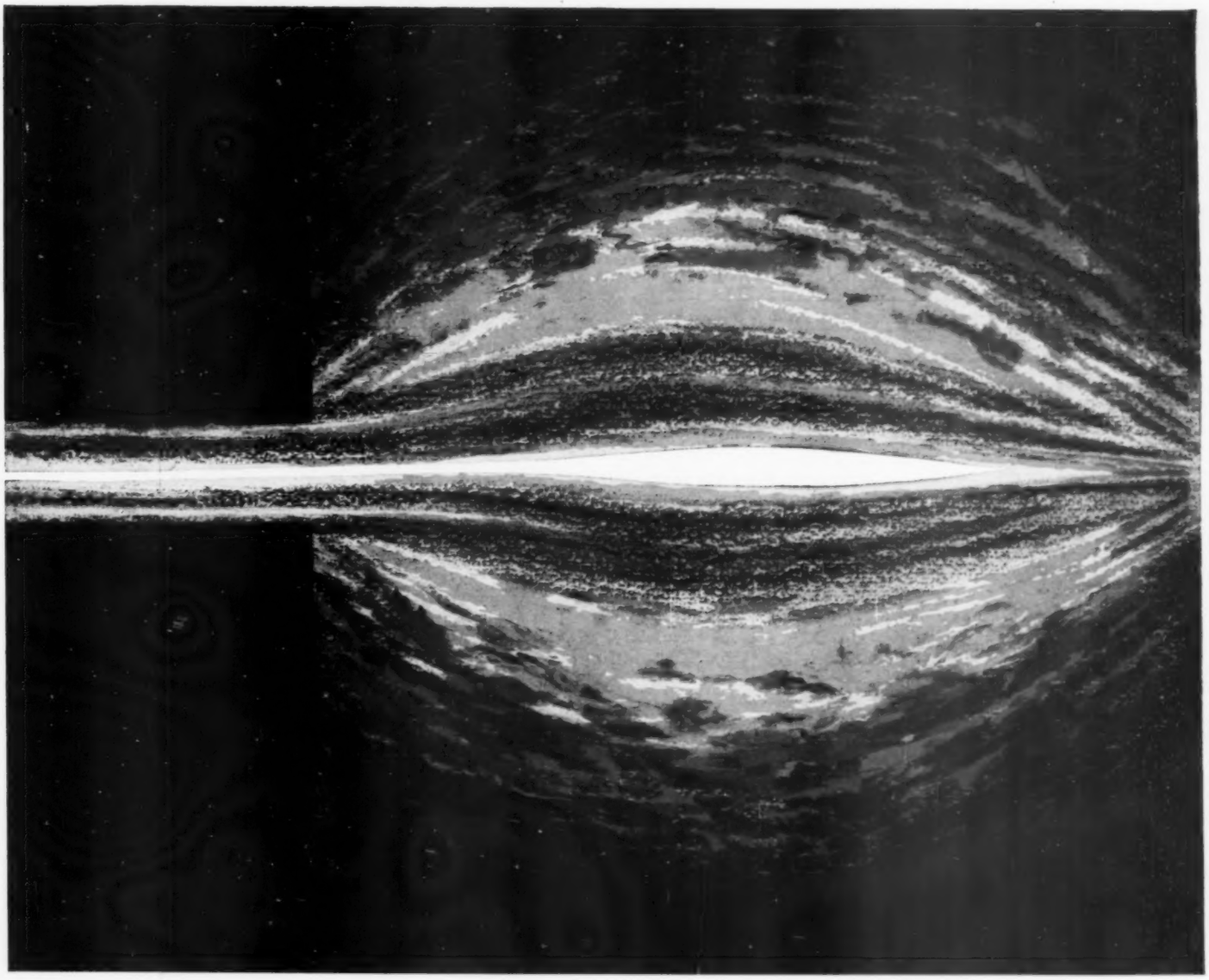

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The technique of steel furnace boosting with a jet of pure oxygen stabilizes quality and batch uniformity.

This principle, whether applied to Open Hearth, Blast or Bessemer, enables manufacturers to widen still further their range of specialized quality steels.

Growing demands of scientific and industrial progress require speedier delivery in the face of increasing competition. It is vital that manufacturers employ this latest technique which shows greater economy and is only made possible by employing the proven principle of the Butterley on-site Tonnage Generator. This compact, efficient plant produced a continuous supply of Oxygen and/or Nitrogen at any desired purity and pressure, piped direct to the point of usage, in the exact quantity desired. Its efficiency eliminates production hold-ups by maintaining a constant supply, and maintenance costs are low.

The Butterley Company have acquired the sole production and sales rights of this, the most successful American Process, for the United Kingdom, British Commonwealth, and certain European countries.

If you can use oxygen, consult

BUTTERLEY FOUNDED 1790 **XYGEN DIVISION**

2

The Butterley Company Ltd., 9 Upper Belgrave Street, London, S.W.1. Telephone : Sloane 8172|3.

Current contracts include : British Celanese Ltd., Brymbo Steel Works Ltd., Imperial Chemical Industries Ltd., Steel Company of Wales Ltd., Stewart and Lloyds Ltd.

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5-7

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New Services • • • New Tools • • • New Methods • • • Outstanding Results

WANT FULL INFORMATION?

For Complete details on McCullough-Magna-Tector (Free Point Finder) and String Shot Back-Off Service write McCullough Tool Company, 5820 South Alameda Street, Los Angeles 58, California. Literature will be sent you by return mail.

Magna-Tector and Chemical Cutter Help Recover 6620' of Stuck Tubing

The use of the Magna-Tector in conjunction with McCullough's new Chemical Tubing Cutter has proved of great value to operators on tubing recovery jobs.

In this instance 2" O.D. tubing, in 5½" casing, was stuck. The Chemical Tubing Cutter was run and a cut made just above a packer set at 6620'. The tubing would not pull and the Magna-Tector was run, locating the lowest free point in the tubing at 6408'. The Chemical Tubing Cutter then made a second cut at this point.

Operator pulled the 6408' of free tubing from the well, washed over the remaining 200' down to the first cut above the packer and removed it from the well with no difficulty.

The two chemical cuts and one run with the Magna-Tector saved what could have been an expensive fishing job.

★ ★ ★

The jobs described above are certified to be true and accurate field reports of services rendered.

3½ Hours Use of Magna-Tector Saves Several Days Fishing Time

Sticking Medium Detected by McCullough Magna-Tector—Reveals Stuck Drill String Could be Recovered Without Back-Off and Washover Operations

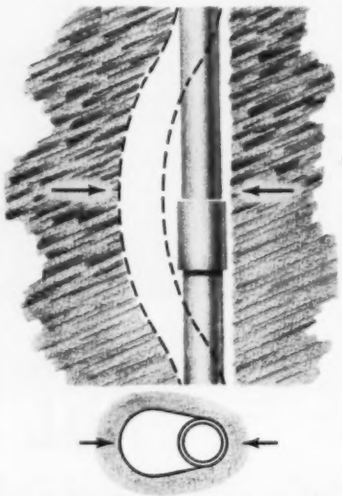
Here's a case where McCullough's Magna-Tector indicated that the entire string of stuck drill pipe could be recovered without time consuming back-off and washover operations.

Drilling at 4345', this Wyoming operator had started out of the hole with drill pipe and nine 6¼" O.D. drill collars when the string stuck. Pipe was worked for 24 hours. Oil was spotted at the drill collars for another 30 hours, without results.

At this point the operator decided back-off and washover operations were necessary. He called for McCullough's Magna-Tector (Free Point Finder) and String Shot Back-Off.

The Magna-Tector was run and readings indicated that the drill collars were working loose. It was recommended that the drill collars be allowed to soak in the oil awhile longer. Five hours later, and working the string frequently, the drill pipe came free.

The operator was very pleased with the information furnished by McCullough's Magna-Tector which saved an expensive back-off and washover job that might have consumed several days rig time.



Illustrated above is a typical key seat, one of the common causes for stuck pipe. If pipe is frictionally held by caving, sand or other material that can be affected by circulation, spotting with oil and working the pipe, the Magna-Tector may detect the condition and will report the progressive loosening as the pipe is freed deeper and deeper down the well.

Call McCullough—for fastest, most economical stuck pipe recovery

McCullough® TOOL COMPANY

Cable Address: MACTOOL

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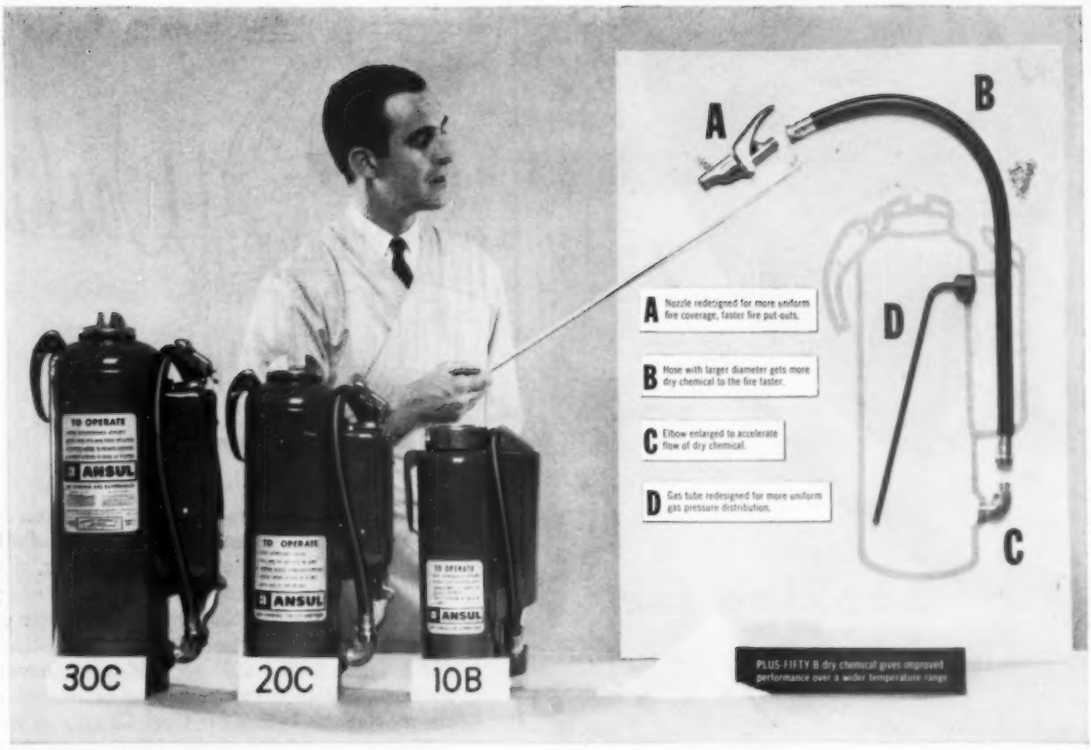
A
B
C
D
A Nozzle redesigned for more uniform fire coverage, faster fire put-outs.
B Hose with larger diameter gets more dry chemical to the fire faster.
C Elbow enlarged to accelerate flow of dry chemical.
D Gas tube redesigned for more uniform gas pressure distribution.
PLUS-FIFTY B dry chemical gives improved performance over a wider temperature range
30C
20C
10B
ANSUL

Important design improvements in these Ansul Extinguishers give you more fire fighting power at no increase in price. Three years of research and more than 2000 fire tests turned up some significant new information on dry chemical extinguishment. Ansul engineers were able to design these findings into three new extinguisher models, the 10B, 20C and 30C. Result, greatly increased fire fighting power. All Ansul equipment is backed by a five-year warranty. This is the best way we know to say Ansul fire extinguishers are the finest of their kind made anywhere.

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Senior Economisers do just that. By taking the valuable waste heat from the flue gases to preheat the feed water they can increase efficiencies by 5 to 15%. Due to their patented H-gilled heat exchange tubes and straight-through, vertical gas passages they combine high effective heat transfer with a minimum draught loss.

A Senior Economiser can be fitted to any type of boiler burning more than 20 tons of fuel weekly, of any type.

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Washington

By Joseph B. Huttlinger

US officials from President Eisenhower on down say they are "encouraged" by the step up in the flow of oil to Europe.

After near "hysteria" about shortages, a dramatic change for the better was recognized in mid-February in new figures from the Middle East Emergency Committee composed of USA oil companies.

According to these, Europe is due to have oil shipments of 2,850,000 b/d in the first quarter of this year—about 94% of the movements before the Suez Canal was closed.

The sources of this oil are: US Gulf, 410,000 b/d; Caribbean, 820,000 b/d; Tapline, 330,000 b/d; Persian Gulf via Cape, 1,-170,000 b/d; Russia and satellites, 120,000 b/d.

Shortly before the canal had been closed, the movements to Europe were 3,030,000 b/d, the MEEC said. The figures were formally given to Congress.

The source of the pre-Suez oil was: US Gulf, 50,000 b/d; Caribbean, 680,000 b/d; Eastern Mediterranean pipelines, 690,000 b/d; Persian Gulf via Suez, 1,450,000 b/d; Far East via Suez, 60,000 b/d; Russia and satellites, 100,000 b/d.

Secretary of the Interior Fred A. Seaton and Dr. Arthur S. Flemming, defense mobilizer, said some of the credit for the improved supply goes to the January appeal from USA officials to industry. Responding to the appeal, some USA refiners cut back their runs to leave more crude oil for Europe, and also changed their yields to make less gasoline and more fuel oil.

Another set of figures was given to congressional committees investigating the oil-for-Europe program and the oil-price rises which followed. These showed Europe is due to obtain at least 80% of her needs for "all oil" in the first quarter.

Breaking this down, Secretary Seaton said gas and diesel products will come to 76% of normal demand; fuel oil, 79%; motor gasoline, 87%.

Meanwhile, M. J. Rathbone, president of Standard Oil Co. (N.J.) told a press conference Europe will get at least 80% of requirements in the first quarter. He hoped the figure would be higher. A few days later, he told the story to the House Commerce Committee, under Representative Oren Harris (D., Ark.), chairman.

A hard and fast ban on crude-oil imports from the Middle East to the USA was urged as a matter of prime importance in the early meetings of the Middle East Emergency Committee. A ban of this sort, it was explained, would provide "the biggest source of additional, effective tanker capacity" for moving more crude oil and products to Europe.

Despite this, the MEEC, composed of USA major oil com-

PIPE LINE

panies, refused to call for such a ban, and preferred "letting the economics of the situation bring about the shift in the movements from the Persian Gulf to the US East Coast." This is disclosed by minutes of eight of the MEEC meetings which are being declassified by the Department of the Interior. They have not been made public generally. The 8 meetings were between August 24 and December 17, 1956.

A number of problems arose to make the matter complex, the minutes showed. Here are some of them:

Crude-oil production by Middle East countries: MEEC considered how to make fair allocations, and decided it was "impossible to suggest any method in advance," and decided to let matters "take their course until inequities developed."

Companies feared cutting too sharply lest the US government hold it against them as it tries to limit imports to the USA. On this, a statement from the US government was suggested—saying it would not be "prejudicial" for the future for a company to cut back imports in this emergency. No such US statement has been seen.

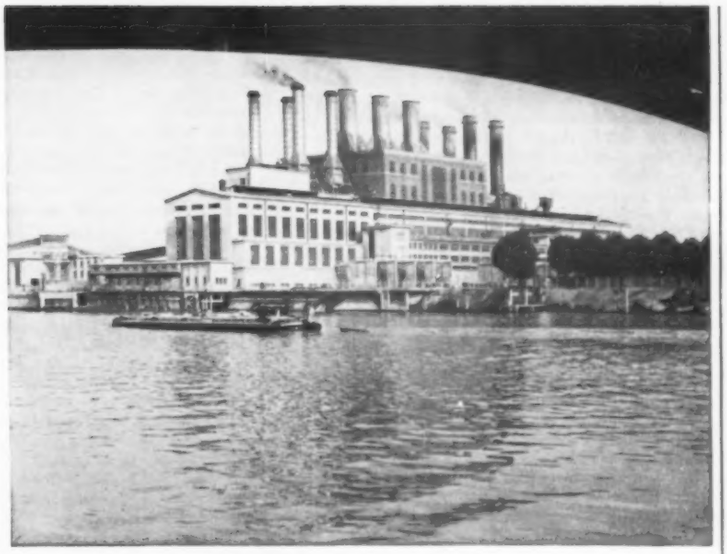
Use of the US reciprocal trade agreement act was studied to cut back crude imports from the Middle East to the USA. This idea was scrapped, and the minutes explained: "It would provide no means for compensating importers for large economic losses involved in the substitution of other crudes for Middle East crudes. It could cause serious "economic loss and serious adverse political reaction in the Middle East."

A voluntary program, drafted by the importers and approved by the government, was suggested and then turned down.

"Nearly all the members," said the minutes, "expressed the view that additional individual economic interest would cause the suppliers to discontinue Middle East imports to the US East Coast to the fullest extent possible since the long haul—Persian Gulf via the Cape—would result in practically a zero netback on the crude imported and that there would be great pressure to use the tankers on the shorter haul from the US Gulf-Caribbean to Europe."

The minutes also took due note of the fact that the MEEC is a "voluntary program." As Chairman Stewart P. Coleman, of Standard Oil Co. (N.J.), was quoted in the minutes: "It was entirely possible that there could not be such unanimous approval when one of the members was being asked to make a very substantial sacrifice."

Aside from pointing to the good to come from cutting out imports from the Middle East, the MEEC pointed to other trouble spots in the oil-for-Europe program. At times, it appears, nothing was done to eliminate the bottlenecks.



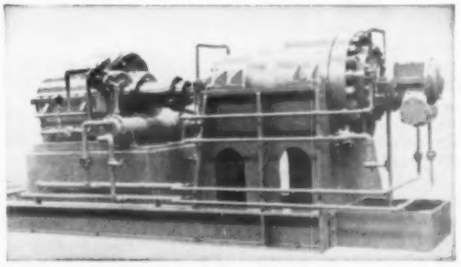
Worthington Boiler Feed Pump provides more than 50,000 hours of service without overhaul or failure

In 1947 a Worthington high pressure boiler feed pump was installed at the Gennevilliers Station of Electricité de France, located on the banks of the Seine near Paris. Since then, the pump has provided continual service for more than 50,000 hours without failure or overhaul.

Electricité de France is unique in that it is the nationalized electric power supplier and distributor in France. The Worthington pump, installed by Société Worthington, was chosen because of Worthington's reputation for flexibility, economic operation and dependability.

Superior features of Worthington Boiler Feed Pumps:

"Twin-volute" casing
All pressure joints are metal-to-metal ring type
Impellers are shrunk on, keyed to shaft
Hydraulic pressure acts to seal, rather than open joints
Inner assembly firmly anchored at inboard end but is free to expand at outboard end with temperature changes
Vernier jackscrews at each end facilitate final adjustment



8-WCS high pressure barrel type boiler feed pump as used in the Gennevilliers Station.

• • • •

For information on Worthington Centrifugal Boiler Feed Pumps, contact your nearest distributor or write to Worthington Corporation, Department O. C., Harrison, N. J., U.S.A.

C57-1E

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Canadian Notes

Saskatchewan Production Up

Pipeline statistics for January and projection for February showed Saskatchewan crude-oil production rising, while Alberta was sliding. Saskatchewan average in December was around 80,000 b/d, while February was estimated 86,500 b/d. Expectation is for more than 40 million bbls. this year, or 110,000 b/d average—about double 1956. Official reports are available only to end of October.

A forecast of 1,200 development well completions for Saskatchewan in 1957 has been made by Hon. J. H. Brockelbank, minister of mineral resources, of which bulk will be drilled in the southeastern Mississippian sector—where January operations made a good start with 63 development wells out of 66 for the whole province; 60 were completed as oil producers. The total count was more than double January 1956, when 29 development wells were drilled. The year's score was 839.

Trans Mountain Delivers 175,000 B/D

Trans Mountain Oil Pipe Line Co. carried an average of 189,377 b/d of Alberta crude to the Pacific Coast in January, following a low of 157,856 b/d in December due to pumping-station fire. Forecast was for 175,000 b/d in both February and March. Interpretation is that offshore market is still unstable, indicated by cut in nominations to 24,000 b/d in February from 34,000 b/d in January.

British American Expands Clarkson Refinery

Fluor Corp. Ltd., Los Angeles engineering-construction firm, has announced its Canadian subsidiary, Fluor Corp. of Canada Ltd., has been awarded a contract in excess of $4,000,000 for additional engineering, procurement, and construction of offsite facilities in conjunction with a major expansion at the British American Oil Co.'s Clarkson, Ont., refinery. The offsite facilities will serve a new reformer and crude unit being built at the refinery.

BP Begins Integration in Canada

British Petroleum (Canada) Ltd., BP affiliate, is planning its first integrated operations on the North American continent. On a 600-acre site purchased early this year, it will build a 30,000 b/d refinery at Ville Danjon on eastern Montreal island. It has also acquired marketing facilities in Montreal and other parts of the province of Quebec.

Details of the refinery have not been announced, but the most up-to-date facilities and processes will be installed which, on completion, probably will cost more than $30 million. Plans for the new refinery include 15,000 b/d catalytic cracking capacity; 9,000 b/d catalytic reforming, as well as facilities for hydrogen treating, alkylation, and possibly polymerization.

BP Canada will become the sixth company to refine oil in Montreal; and, like other refineries in the area, will operate on foreign crude. As Kuwait is British Petroleum's principal foreign crude source, its Canadian refinery probably will process Middle East crude.

Although British Petroleum has operated in Canada since 1953, when it acquired an interest in Triad Oil Co. Ltd., of Calgary, until recently BP operations have been in oil exploration—principally in the western provinces of Alberta, British Columbia, Saskatchewan, and Manitoba.

With the acquisition of a refinery location and choice service-station sites in Montreal and other parts of Quebec, British Petroleum (Canada) Ltd. has entered one of the world's fastest growing oil markets.

To Complete 60% All-Canadian Gas Line This Year

By the end of 1957, almost 60% of the 2,294-mile all-Canadian natural-gas pipeline will be complete, according to J. L. Parrish Jr., chief engineer of Trans-Canada Pipe Lines Ltd.

The moment weather conditions permit, work will resume to complete the 34-in. trunk line between the Alberta-Saskatchewan border and the Manitoba-Ontario border. On that section, 230 miles of pipe have been laid, and crossing of the Assiniboine River in Manitoba at two points has been achieved. Operation this year will commence at a point near Regina, Saskatchewan, and pipelaying will continue eastward to Winnipeg, where Alberta natural gas is due September 1 next.

During 1957, too, 30-in. pipe will be laid 85 miles from Winnipeg to the Manitoba-Ontario border. From that point, Trans-Canada will supervise construction by the Crown Corp. of another 310 miles of 30-in. pipe to Port Arthur, making gas available there by the fall. As part of the construction program in 1957, Trans-Canada also will build 308 miles of 20-in. pipe from a point north of Toronto to Ste. Anne de Bellevue, at the western end of the island of Montreal.

Between Regina and Winnipeg, Mr. Parrish explained recently, 34-in. pipe has been delivered all winter, and already is strung along the right-of-way. Within a short time Trans-Canada will begin taking delivery of 30-in. pipe; major suppliers are located in Welland, Ontario; and Middlesbrough, England. Altogether about 200,000 tons of the 30-in. line will be brought across the Atlantic, the move involving some 100 shiploads.

To complete the Trans-Canada system, according to Mr. Parrish, the gas line will pass under railroads at 96 points; there will be 202 highway crossings. The pipe will be sunk under the bed of 8 lakes; 99 rivers; and 77 streams, creeks, and canals. There will be rock excavation over 356½ miles, and special construction through swampy ground over 139¼ miles.

New Saskatchewan Maps

The Saskatchewan Department of Mineral Resources has completed a series of regional structure contour maps showing the configuration of different strata underlying the earth's surface. The maps are presented as blue-line prints, and may be obtained from the Department of Mineral Resources, Petroleum and Natural Gas Branch, Administration Building, Regina. The cost is $5 per sheet.

Husky Canadian Subsidiary

Husky Oil & Refining Ltd. is now a wholly-owned subsidiary of Canadian Husky Oil Ltd., according to an announcement by Glenn E. Nielson, president of both companies. The new status became effective on January 24, when Canadian Husky completed the acquisition of all the outstanding common and preference shares of Husky Oil & Refining Ltd. Canadian Husky had owned approximately 60% of the Husky Oil & Refining Ltd. voting shares since 1953.

Slave Point Discovery by Home Oil

A significant oil discovery has been made by Home Oil Co. in the Slave Point section, northwest of Edmonton. Production was obtained on a drill-stem test from 7,795 ft to 7,923 ft of 40 API gravity oil as a final flow pressure of 1,120 psi.

This is significant because it is the second discovery in the Middle Devonian; a previous find was made by Home Oil some 25 miles southwest, and may herald a major field.

Scurry-Rainbow Oil and Canadian Pipelines To Merge

Announcement has been made in New York that a merger of Scurry-Rainbow Oil Ltd. and Canadian Pipelines & Petroleums Ltd. has been approved by the boards of directors of the respective companies, producers of oil and natural gas with extensive land holdings in the three oil provinces of western Canada. The combined company will retain the corporate name of Scurry-Rainbow Oil Ltd.

The consolidated company will be one of the largest and strongest independent oil companies in western Canada. It will have holdings in 8,500,000 gross acres and 2,900,000 net acres, located in the three chief western oil provinces of the dominion.

Opens Calgary Office

An exploration office has been established in Calgary, Alberta, by Kerr-McGee Oil Industries Inc., which currently is conducting a study of the geology of western Canada, preparatory to launching a program of active exploration.

John A. Masters is manager. He has been manager of uranium exploration for Kerr-McGee. District geologists are Gerald C. Loucks and Robert L. Duncan.

Kerr-McGee's Canadian office is located in the Fisk Building, corner of Seventh Avenue and Third Street Southwest, in Calgary.

Canadian Reserves Up 13.5%

Reserves of petroleum in Canada rose 13.5% in 1956, according to the Reserves Committee of the Canadian Petroleum Assn. This is a net figure, after record high production during 1956.

Proved reserves of petroleum rose to 3.129 billion barrels as of last December 31, an increase of 373 million barrels over the 1955 high. Reserves now include 2.849 billion barrels of crude oil, and 280 million barrels of natural-gas liquids.

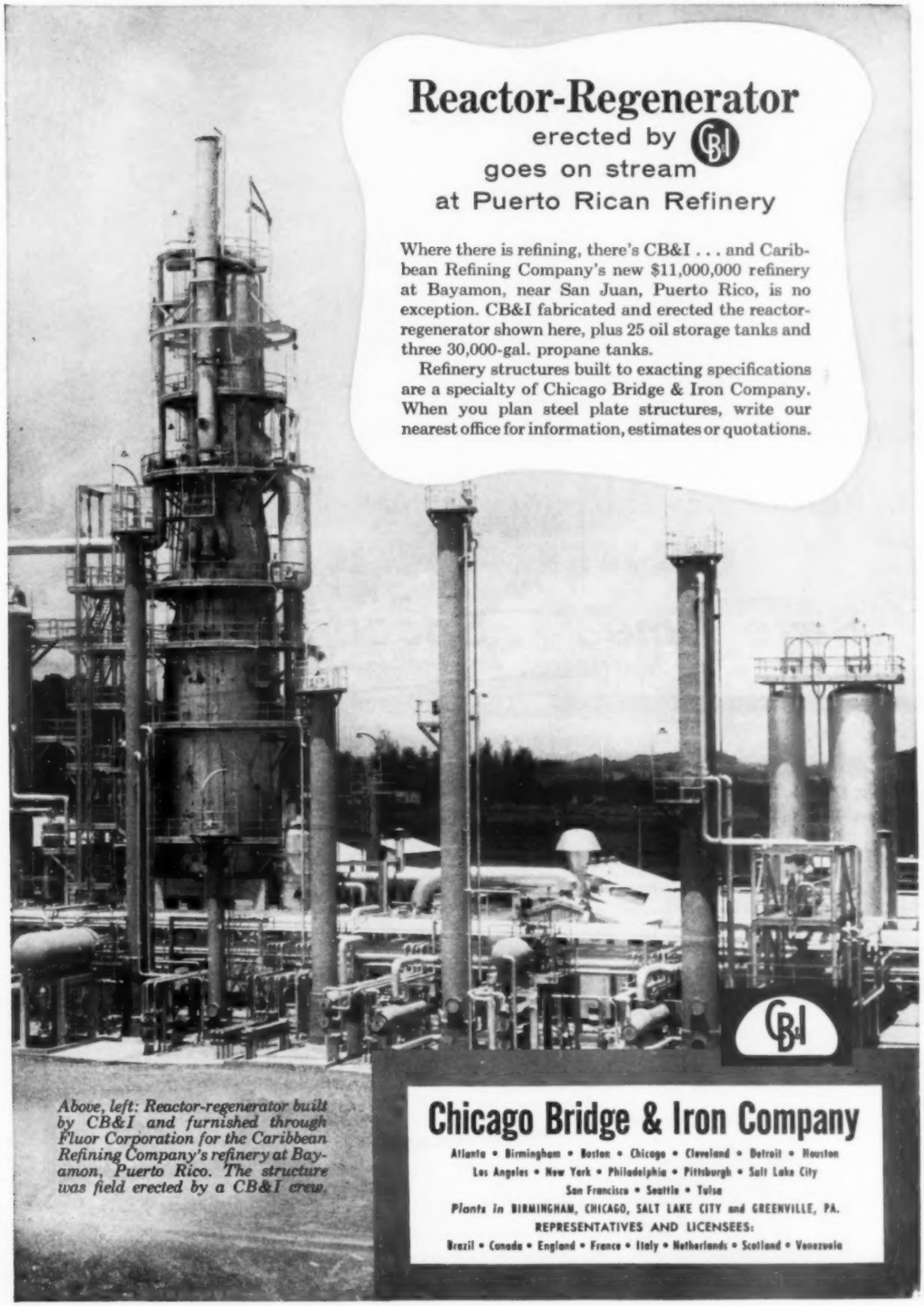
Natural-gas reserves in Canada are estimated to have risen 2.7 trillion cubic feet and, as of September 30, 1956, totaled 18.3 trillion cubic feet. The Conservation Board has estimated commercially recoverable reserves at 16.5 trillion cubic feet, out of the total.

Oil production in Manitoba increased nearly 4 times during 1956—to 5.7 million barrels; in 1955 production was 1.6 million barrels in the province.

PROVED RESERVES IN CANADA
(Thousands of Barrels)

	Proved Reserves as of Dec. 31, 1955	Changes in Proved Reserves due to Extensions (New Oil) and revisions during 1956	Proved Reserves discovered in New Fie'ds and in New Pools in Old Fie'ds in 1956*	Production during 1956	Proved Reserves as of Dec. 31, 1956 Columns 1, 2 & 3 less Column 4	Changes in Reserves during 1956. Column 5 less Column 1
	(1)	(2)	(3)	(4)	(5)	(6)
CRUDE OIL						
Northwest Teritories	53,707	—	—	449	53,258	—449
Alberta & British Columbia	2,169,985	344,213	19,721	142,141	2,391,778	221,793
Saskatchewan	2[illegible]	119,711	28,394	20,284	358,693	121,821
Manitoba	45,211	2,577	56	5,839	42,005	—3,206
Ontario and New Brunswick	3,759	465	20	603	3,636	—123
TOTAL CRUDE OIL	2,509,534	460,966	48,191	169,321	2,849,370	339,836
# NATURAL-GAS LIQUIDS	247,085	20,505	15,000	2,656	279,934	32,849
TOTAL LIQUID HYDROCARBONS IN CANADA	2,756,619	481,471	63,191	171,977	3,129,304	372,685

* Figures in this column may be considered minimum figures.
\# All natural-gas liquids located in Alberta and British Columbia.



Reactor-Regenerator

erected by CB&I goes on stream at Puerto Rican Refinery

Where there is refining, there's CB&I . . . and Caribbean Refining Company's new $11,000,000 refinery at Bayamon, near San Juan, Puerto Rico, is no exception. CB&I fabricated and erected the reactor-regenerator shown here, plus 25 oil storage tanks and three 30,000-gal. propane tanks.

Refinery structures built to exacting specifications are a specialty of Chicago Bridge & Iron Company. When you plan steel plate structures, write our nearest office for information, estimates or quotations.

Above, left: Reactor-regenerator built by CB&I and furnished through Fluor Corporation for the Caribbean Refining Company's refinery at Bayamon, Puerto Rico. The structure was field erected by a CB&I crew.

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PEMEX has a modern fleet of White Trucks—saving delivery time and costs. Shown above are two of the fleet of 35 new White Model 3022 Tankers now in service. Other modern Whites have just been delivered to Pemex Refining and Production divisions.

It takes modern motor trucks—tailored carefully to work requirements—for greater efficiency. You can get it with Whites.

AUTOCAR for Pemex Transport

Typical of the husky Autocars serving Pemex is this Autocar diesel-powered tractor model DC103 with 197" wheelbase and the famous Autocar Driver Cab. The truck tank hauls 2,200 gallons and trailer 4,400 gallons. These transport units deliver fuel throughout Mexico.

Modern White and Autocar Sales and Service facilities are established in principal markets of the world.

White

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Export Division • Cleveland 1, Ohio, U. S. A. • Cables: Whitco

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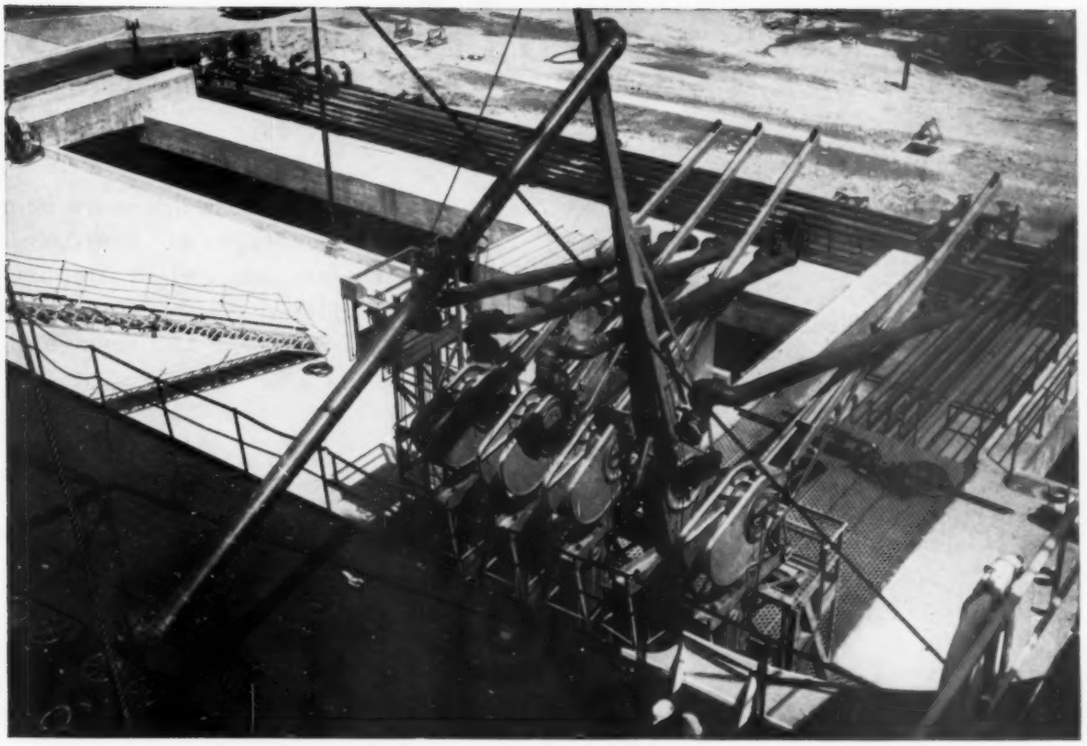


IN SHIPPING—

CHIKSAN MARINE LOADING ARMS

GIVE A MODERN DAY LIFT TO TANKER LOADING!

Hooking up hose lines to a tanker is often a rough, dirty, and sometimes dangerous task. However, loading drudgery is becoming just a memory wherever the new Chiksan Marine Loading Arm has gone into service. Heralded by many as the first basic improvement in the loading of marine tankers in over 30 years, the new Chiksan Loading Arm not only insures faster tanker turn-around time, but promises material savings of lost man-hours due to hose handling injuries, insurance and compensation premiums, and expensive rubber hose replacements. Savings within a decade, one customer estimates, will actually amount to the purchase price of a 5-arm unit. For descriptive literature, write Chiksan, Brea, California.

Where once a crew of seven men labored for 30 minutes to hook up a rubber line, now one man operating hydraulic controls can swing a Chiksan Loading Arm aboard, for hook up, in less than a minute.

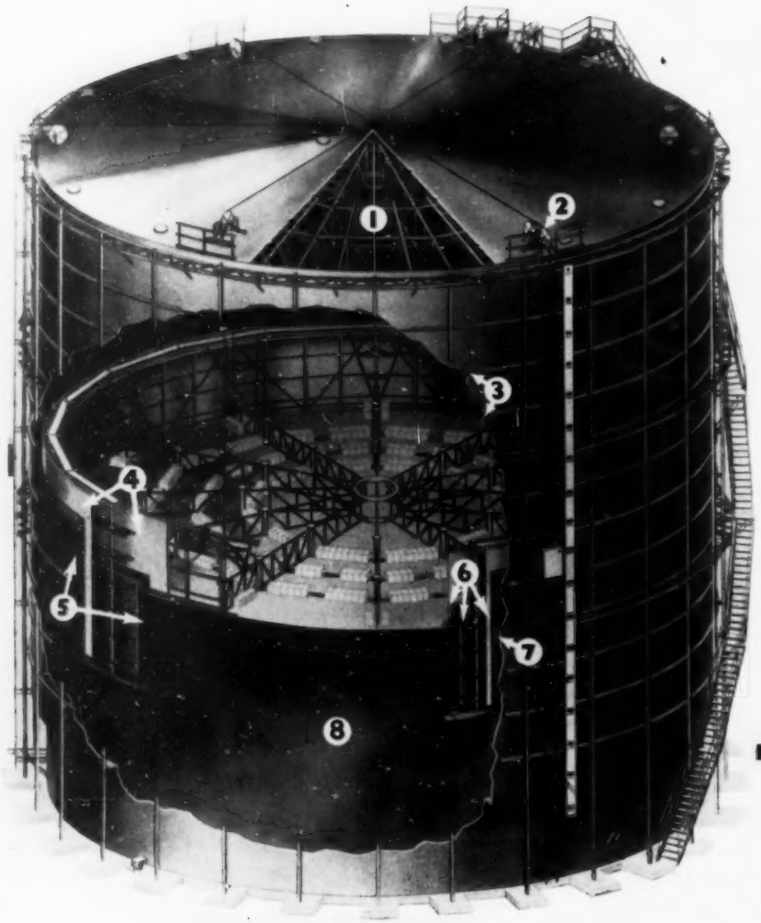
A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

fmc CHIKSAN

CHIKSAN COMPANY—BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

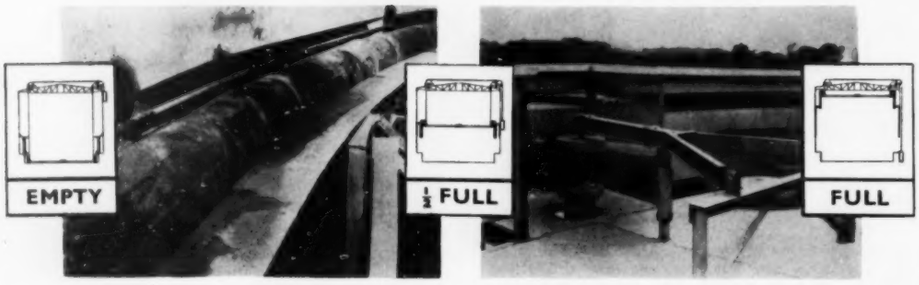
Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Company • Chiksan of Canada Ltd.

FEATURES OF THE *Wiggins* DRY SEAL GASHOLDER



Wiggins Gasholders are being used for the storage of hydrogen, nitrogen, towns gas, carbon monoxide, carbon dioxide, oxygen, coke oven gas, tetrafluorethelyne and sewage digester gas, etc.

The Wiggins Gasholder operates on the principle of piston displacement. A frictionless, movable piston floats on the confined gas, rising and falling with changes in volume. The seal—a synthetic rubber-coated fabric—is protected against wear by ample clearances. The system requires practically no maintenance and no replacements. The Wiggins Gasholder is a structure free of unsightly framework.



Half full position, showing inflated seal constructed of a synthetic rubber-coated fabric.

Full position view of mechanically-operated relief valve. Releases gas if holder capacity is exceeded.

1 The piston rises nearly to the roof of the gas-tight shell giving maximum capacity.

2 A single automatic levelling device keeps the piston riding level.

3 The section of the shell above the piston is completely ventilated.

4 Wide clearances prevent friction.

5 The gas-tight seal remains unaffected by weather.

6 Fenders protect the seal when under pressure and guide it on to the side walls without friction.

7 The shell is gas-tight up to the seal connection.

8 Foundations are simple and inexpensive as only the shell weight has to be supported.

ASHMORE, BENSON, PEASE & CO

(MEMBER OF THE POWER-GAS GROUP)

STOCKTON-ON-TEES AND LONDON

AUSTRALIA · CANADA · INDIA · FRANCE · SOUTH AFRICA

304

the promise

he will see

performed

Today it's only a test. A trial run to show what the iron horse can do. But this boy will see these fields worked by many such machines. He will raise more grain per field than his fathers would have dreamed possible. He will enjoy a richer and a fuller life.

This is no mere guess, but the informed judgment of Standard-Vacuum people who see its beginnings throughout the vast area they serve – Asia, Africa and the lands of the Pacific. And Stanvac will be ready with the petroleum needed by these peoples to power and lubricate the machines that will make their progress possible.

Here in the Orient Stanvac finds the oil. Here it flows from the wells. Here it is transported and refined. And here, in many forms, it is supplied to those who need it. The people know Stanvac and what it means to them, and Stanvac is determined to deserve their trust.

STANDARD-VACUUM OIL COMPANY **POWERS PROGRESS**

White Plains, New York

AHWAZ TO AZNA

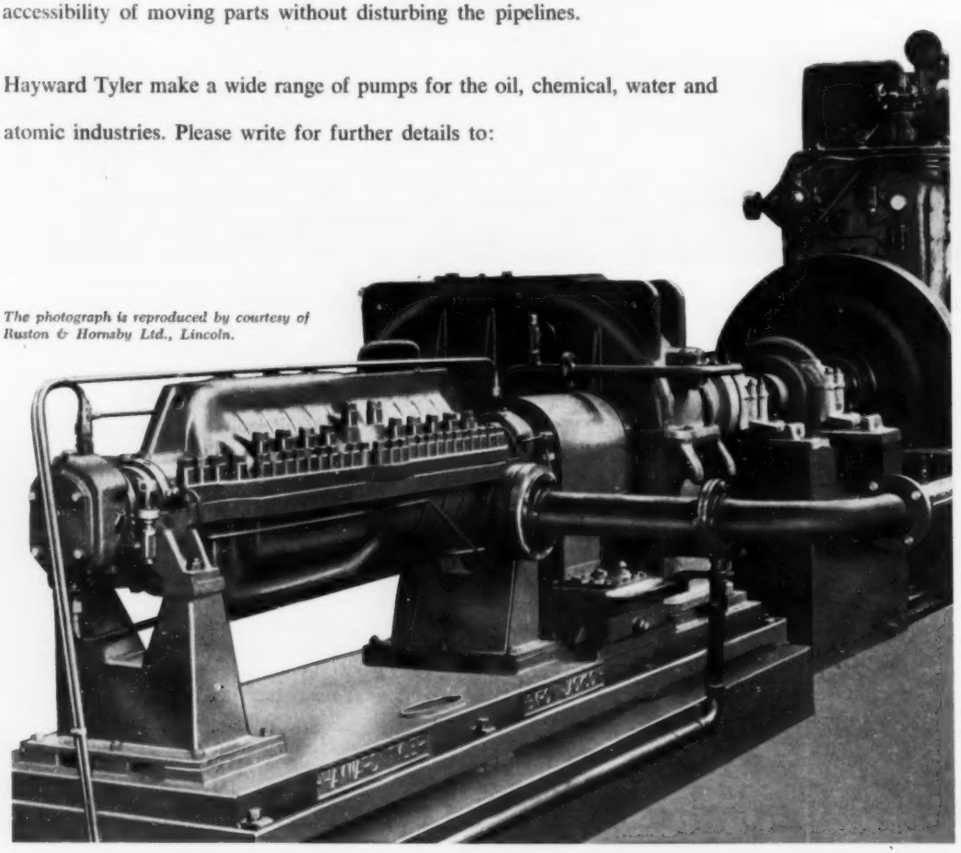
(Three hundred miles)

Six Hayward Tyler-Byron Jackson 12 stage Multiplex pumps are now delivering at the rate of a million tons of petroleum products each year through the new Trans-Iranian pipeline which, at one point, climbs to 7000 feet above sea level.

These pumps, together with three identical standby units, are driven by Ruston & Hornsby diesel engines through David Brown step-up gearboxes to give an impeller speed of 3,900 R.P.M. (Max.)

Each pump delivers 375 G.P.M. at a discharge pressure of 1000 P.S.I. The hydraulic design eliminates both side and end thrust, thus minimising the load on the bearings. Split casing construction gives complete accessibility of moving parts without disturbing the pipelines.

Hayward Tyler make a wide range of pumps for the oil, chemical, water and atomic industries. Please write for further details to:



The photograph is reproduced by courtesy of Ruston & Hornsby Ltd., Lincoln.

HAYWARD TYLER

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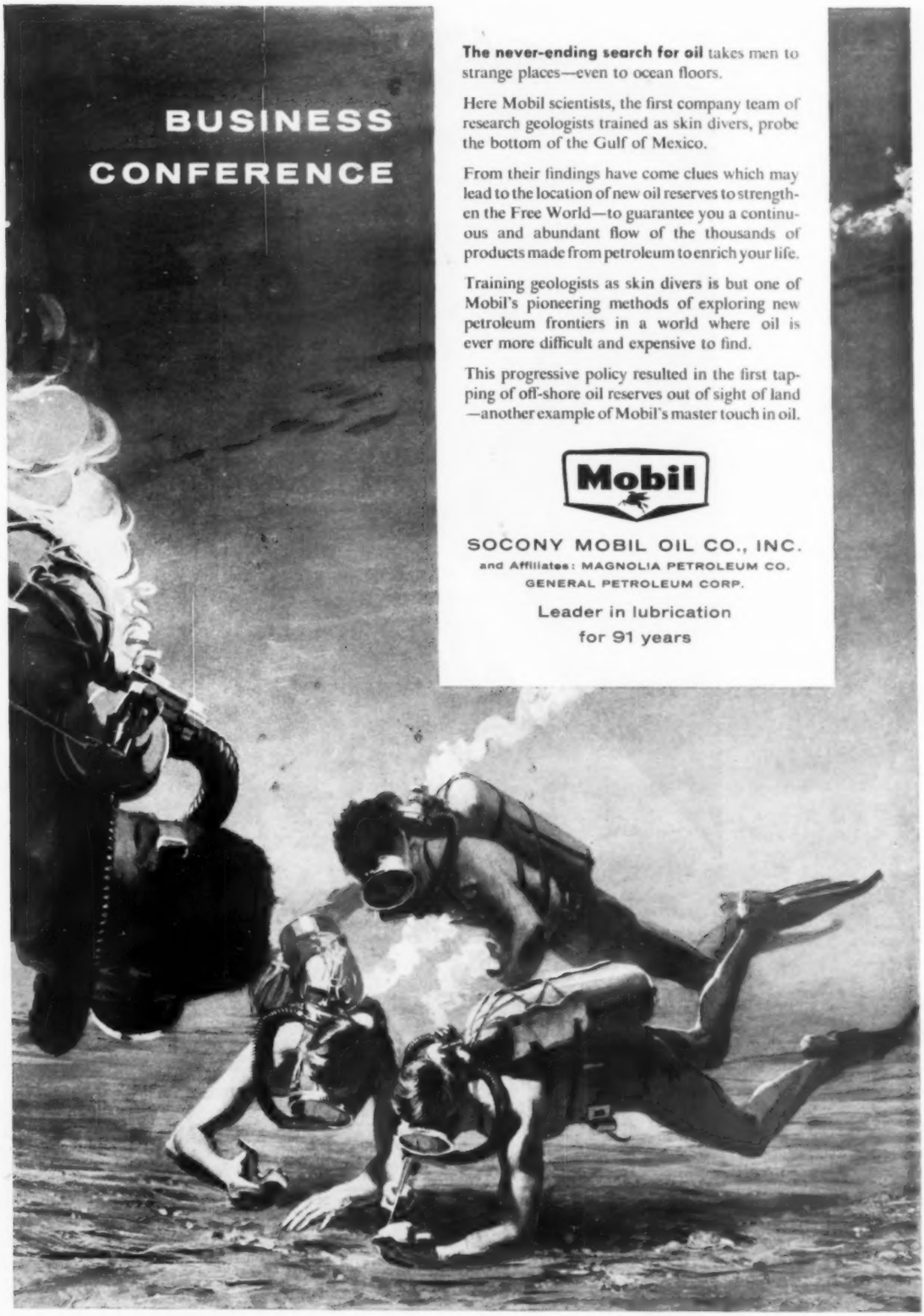
LONDON OFFICE: SALISBURY HOUSE · FINSBURY CIRCUS E.C.2. NATional 9306



The never-ending search for oil takes men to strange places—even to ocean floors.

Here Mobil scientists, the first company team of research geologists trained as skin divers, probe the bottom of the Gulf of Mexico.

From their findings have come clues which may lead to the location of new oil reserves to strengthen the Free World—to guarantee you a continuous and abundant flow of the thousands of products made from petroleum to enrich your life.

Training geologists as skin divers is but one of Mobil's pioneering methods of exploring new petroleum frontiers in a world where oil is ever more difficult and expensive to find.

This progressive policy resulted in the first tapping of off-shore oil reserves out of sight of land —another example of Mobil's master touch in oil.

Mobil

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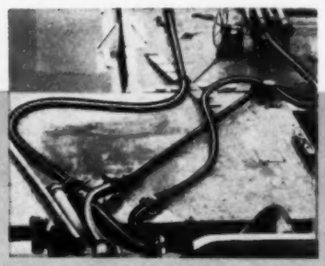
GENERAL PETROLEUM CORP.

Leader in lubrication
for 91 years

A COMPLETE LINE OF PETROLEUM TRANSPORT HOSE

A hose for every purpose from U.S. Rubber...



FIRST with U. S. Amazon H-1515 Oil Discharge Hose.

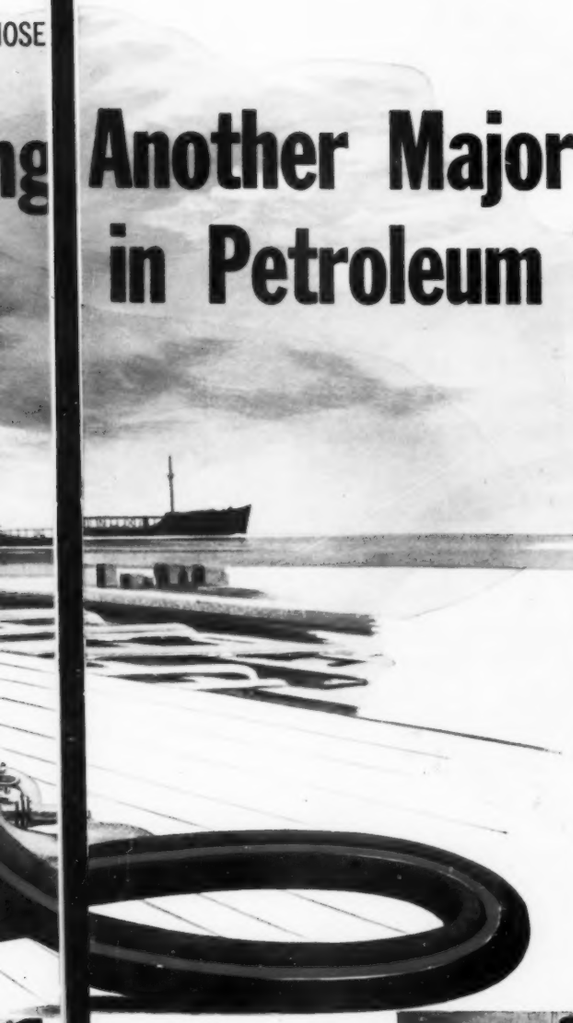
Flexible smooth-bore, ⅔ lighter, takes up to 200 lbs. working pressure, needs less handling gear. Make-up time is reduced and accident hazards lessened.

FIRST with U. S. Amazon H-1818 Smooth Bore O S & D Hose.

Takes up to 200 lbs. operating pressure, withstands the roughest handling, has up to 100% greater hydrostatic values, extreme flexibility. H-1818 is the only burstproof smooth-bore hose.

US RUBBER **U. S. Rubber**

Another Major Achievement in Petroleum Transport Hose



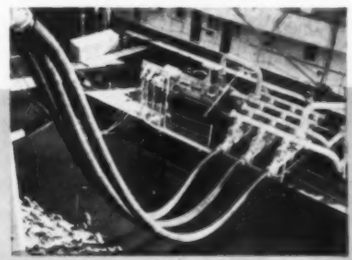
Now, from U. S. Rubber, the world's pioneer oil hose manufacturer, comes new additions to its line of Amazon® petroleum dock hose. There is a hose for every requirement—dock, barge loading and general loading services — rough bore or smooth, for extra high or normal working pressures.

Each hose has qualities that cannot be found in any other make hose of similar type — qualities of easier handling, greater flexibility, higher hydrostatic value — all of which make U. S. Amazon superior to any other hose on the market.

The new, complete line of U. S. Amazon petroleum transport hose is manufactured in the United States, Canada and Great Britain. For further information write to U. S. Rubber International, 1230 Avenue of the Americas, New York 20, N. Y.

AND NOW
TO COMPLETE THIS MOST UP-TO-DATE LINE OF DOCK HOSE, U.S. RUBBER IS ONCE AGAIN...

FIRST with U. S. Amazon H-2020 Rough Bore Oil Suction & Discharge Hose.
For 200 lbs. working pressure. Both inner and outer supporting wires double the hydrostatic values. Also suitable for hot asphalt and heated oils. Absolutely burstproof.



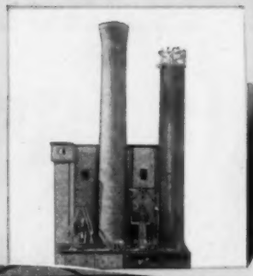
FIRST with U. S. Amazon H-2424 Rough Bore Wire Cord O S & D Hose.
For 150 lbs. working pressure, contains inner supporting wire in bore; specially designed carcass has each wire imbedded in its own neoprene layer. Conducts any petroleum product. Very flexible.

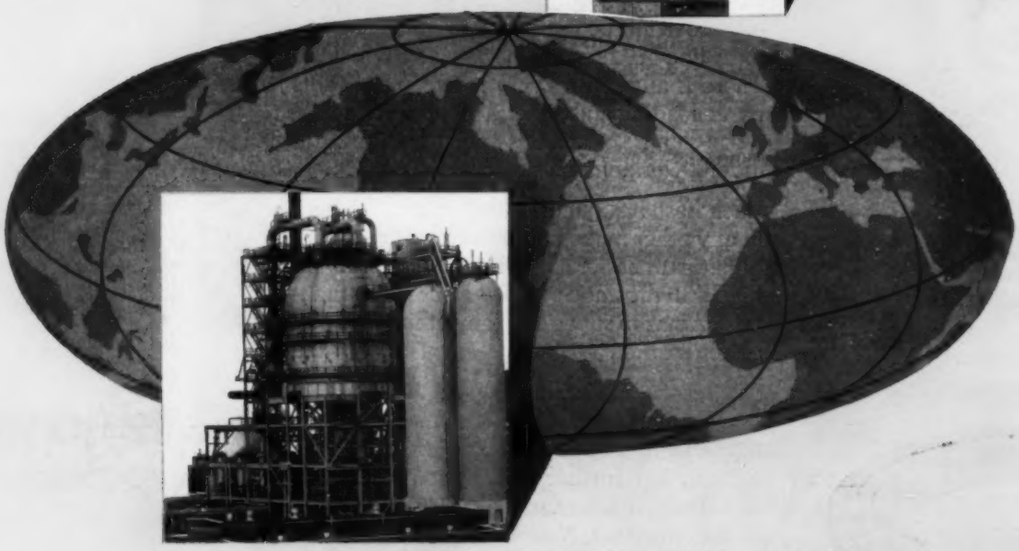
Products bearing the U. S. Rubber mark of quality are manufactured in: ARGENTINA • BELGIUM • BRAZIL • CANADA COLOMBIA • CUBA • GREAT BRITAIN • ITALY • MEXICO • PUERTO RICO • SOUTH AFRICA • SWEDEN • UNITED STATES OF AMERICA • URUGUAY • VENEZUELA, and are sold by U. S. Rubber branches and distributors throughout the world.

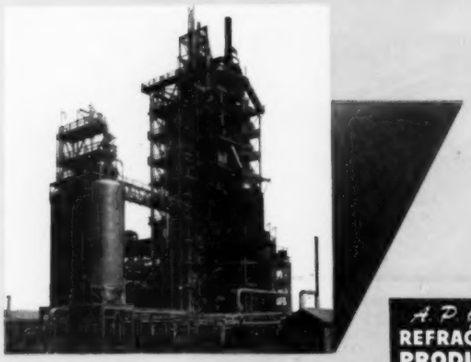
ALL OVER THE WORLD

A. P. GREEN

Serves the Refinery Industry with a Complete Line of High Quality Refractory Products







Throughout the world, the refinery industry relies on A. P. Green high quality refractories for dependable service in thermal and catalytic cracking units, heaters, boilers, stacks, etc.

A world-wide network of A. P. Green distributors is always ready to help you select the right refractories to do the best possible job . . . at the lowest cost. Regardless of location, A. P. Green refractories reach you quickly, safely, exactly as ordered.

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DU PONT *Petroleum Chemicals* NEWS

One of a Series of Bulletins for the Petroleum Industry

APRIL 1957

Experiments reveal facts about carburetor icing

Recent experiments indicate that stalling due to carburetor icing occurs even in 55-degree weather. Moreover, they prove that Du Pont DMF (dimethyl formamide) provides the motorist with protection against this type of hazard and annoyance.

Stall-prevention is especially important in many cars having power brakes and power steering—both of which are less effective when the car-engine stops.

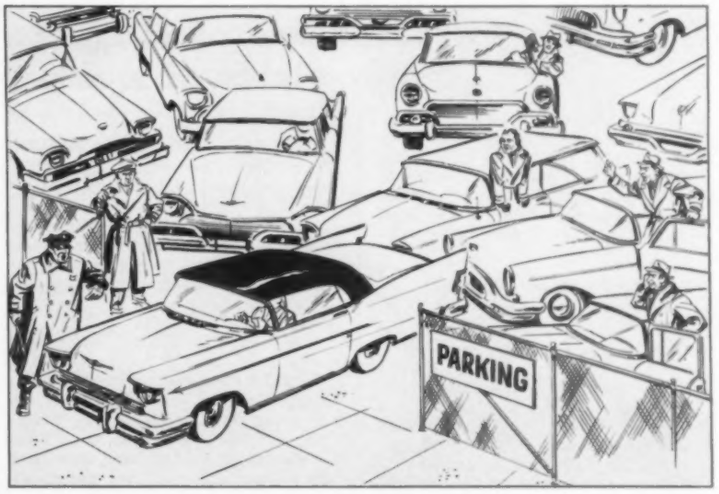
GENERAL MANAGER ORGANIC CHEMICALS DEPARTMENT

SAMUEL G. BAKER began his career in 1923 on a dynamite production line at the Du Pont explosives plant in Washington. Six months later, he left the company to resume his university career.

After graduating in chemical engineering from the University of Washington, Mr. Baker returned to Du Pont

in 1925 as a chemist at the Eastern Laboratory and the Repauno Works in Gibbstown, New Jersey. In 1939, he was named Director of Sales of High Explosives Manufacturing Division. Four years later, Mr. Baker joined the Electrochemicals Department, where he became General Manager in 1948.

He became General Manager of the Photo Products Department in 1950. The Organic Chemicals Department is the third department Mr. Baker has headed. He was appointed General Manager of that department late last year.



STALLS DUE TO carburetor icing often happen at the most inconvenient times, such as the rush-hour traffic jam in the parking lot above—caused by the stalled car at the exit gate. Our growing traffic congestion especially points up the need for eliminating situations like this. When Du Pont DMF is added to gasoline, it effectively prevents carburetor icing stalls which occur under a wide range of temperature and humidity conditions.

Dimethyl formamide proved effective in low concentrations

Its practical use concentration turned out to be under 0.10 volume per cent—in other words, less than three milliliters per gallon!

Long stalling season

Conditions under which your customers' cars can stall also became clearer. The "refrigerant" action of gasoline can lower the temperature of carburetor parts to freezing even on comparatively warm days. Generally speaking, temperatures from 22 to 55 degrees Fahrenheit can lead to carburetor icing when humidity is 65 per cent or higher.

Expanding de-icer market

Motorists are showing an ever-increasing interest in gasoline performance. By anticipating a greater demand next fall for gasolines which contain anti-stalling agents, you can increase the

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT *Petroleum Chemicals* NEWS

New Du Pont engine assembly demonstrates carburetor icing

MARKETER:

So this is the apparatus you use to demonstrate carburetor-icing characteristics of gasolines?

DU PONT REPRESENTATIVE:

Yes, it consists of a 1.6-horsepower engine connected to a small ice tower by a glass tube manifold.

MARKETER:

I see there's a build-up of ice on the little metal throttle plate in the tube . . .

DU PONT REPRESENTATIVE:

That's right. The fuel being tested contains no anti-icing additive — see, the engine just stalled! Now watch it take hold again when the DMF is added.

MARKETER:

Say, this unit would come in handy at our next dealer meeting . . .

DU PONT REPRESENTATIVE:

We'll help you build one. You'll find it very convincing for selling dealers and customers on your new NO-STALL GASOLINE with DMF.

Increased use of additives leads to greater yields of stable products

When insoluble residues form in distillate fuels, it usually means trouble for the user – and often for the supplier. Maintaining fuel stability is the key to solving this problem. And, in most cases, the use of additives has been found to be the most economical solution.

The trouble and the cure

Residue formation is more of a problem today than ever before because of the increased use of catalytically cracked stocks. Although cat-cracked stocks are as good as straight-run stocks in heating value, they are generally less stable in storage. As a result, users experience troubles caused by sludge.

In the case of domestic heating oils, for example, unstable stocks can lead to plugging of filters, nozzles and other parts. Du Pont Fuel Oil Additive No. 2 (FOA-2), a stabilizer and dispersant, inhibits the formation of those sediments.

Diesel fuels improved with FOA-2

Users of diesel fuels also encounter stability problems. The formation of insoluble residues in cat-cracked stocks can lead to injector-sticking, build-up of undesirable deposits in combustion chambers and loss in engine performance. Diesel fuel refiners are discovering that these problems, too, can often be overcome by the addition of Du Pont FOA-2 to their cat-cracked stocks.

FOA-2 is ideally suited for stabilizing all types of fuel oils. A small amount will not only prevent formation of residues, but will disperse them as well. Thus it tends to rid oil-feed systems of any sludge that may have previously formed.

Technical paper available

As the need for greater fuel stability grows, you will be looking for the most economical way of obtaining it. In a technical paper entitled "Improving Fuel Oils through the Use of Additives," W. deB. Bertolette and J. D. Rogers describe additive treating as a relatively simple operating procedure and point out how economical it is compared to refining or other treating processes.

To get your free copy of this paper, just send your request to any of our sales offices listed on this page.

CONTINUED

Carburetor Icing

number of your cold-weather customers. Now is the time to anticipate the day when temperatures begin dropping below 55 and carburetor icing begins.

Economy and reduced storage

DMF offers two important benefits—economy and minimum storage-space requirement. The low volume concentration that's needed represents a real saving in freight and blending costs. And, because of the high efficiency of Du Pont DMF, and the low concentration required, little storage space is necessary.

See the "demonstration" of DMF, top of page.

A Du Pont Petroleum Chemicals Division representative will be glad to give you more detailed information on DMF. You can contact him at any of our sales offices listed at right.

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. . . through Chemistry

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-4216

Printed in U. S. A.

NOW *a Modern Fittings Package*

one more reason for specifying
W-S FORGED STEEL FITTINGS

W-S Forged Steel Fittings are now being shipped in strong, lightweight fiberboard cartons designed to make purchasing a pleasure. Shipments are made up of unit cartons packaged inside a larger reinforced carton. It's easy... and advantageous to order your fittings in packaged quantities.

Here are additional advantages of the new W-S package:

1. Compact and easy to handle.
2. Ideal for neat, efficient stacking on warehouse and stockroom shelves.
3. Sealed against dust and moisture.
4. Contents clearly marked on outside face of each carton, readily visible for prompt identification.

The new W-S package is only one of many reasons why W-S Forged Steel Fittings are the most widely accepted by industry.

Don't forget, too, W-S carbon steel fittings have the additional protection of their new blue synthetic coating. For detailed information on packaged lots ...and for a copy of our new fittings catalog, write today to W-S Fittings Division, H. K. Porter Company, Inc., Roselle, N.J.

HKP W-S FITTINGS DIVISION
H. K. PORTER COMPANY, INC.

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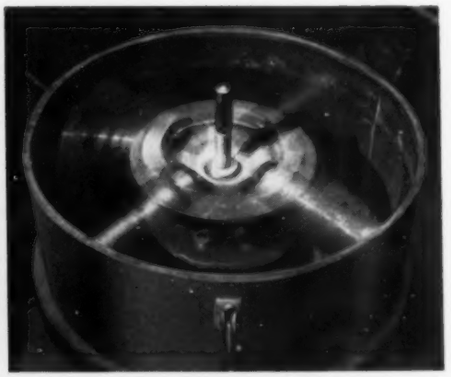
BY APPOINTMENT TO HER MAJESTY THE QUEEN
Suppliers of Fire Extinguishers The Pyrene Company Limited

Putting out oil fires before they happen

Results more than justify the reliance which the oil industry places on 'Pyrene' foam for ensuring the fire safety of refineries, tank farms and dock installations throughout the world. To warrant this confidence . . . to make certain beyond all doubt that 'Pyrene' Foam Compound will at all times and in all circumstances provide the means of extinguishing fire quickly and conclusively, is the constant task of a team of chemical engineers in the Pyrene laboratories. Through their vigilance the most scrupulous production control is maintained over every gallon of 'Pyrene' Foam Compound that is manufactured, ensuring its unfailing efficiency and dependability wherever and whenever it may be called into action.

Seen distorted through the water bath which maintains the critical temperature of his apparatus, a physicist checks the viscosity of a sample batch of 'Pyrene' Foam Compound. The test determines that when brought into action 'Pyrene' foam will retain its free-flowing yet tenacious characteristics at all normal operating temperatures, down to 20° Fahrenheit.

Within the spinning container of the torsional viscometer a one-minute-old sample of foam, made from 'Pyrene' Foam Compound, deflects a vane suspended by a steel wire. The degree of twist in the wire is the measure of the foam's viscosity—of its critical and continuous shear stress values—indicating its ability to 'cling' as well as spread easily.



Under the tremendous force of the laboratory centrifuge the slightest trace of sediment in this sample batch of 'Pyrene' Foam Compound is settled out, carefully collected, measured and recorded. . . . Under no circumstances will the batch be approved unless this test shows it to be sludge-free, in accordance with the exacting Pyrene production specification.

"Pyrene" Foam Generators and Foam-making Branchpipes • Fixed Foam Installations • Foam Towers • Foam Monitors • Foam Tenders and Trailers designed to meet *all* oil fire risks. Write for details on the latest developments to Dept. W.P. 3

Pyrene TRADE MARK foam compound

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IN CANADA: DIKKERS, LTD., SCARBOROUGH, ONTARIO

Standard tries a flood of fire to make worn out oil fields produce again

Fire flooding produces heat and pressure to boil out previously unrecoverable crude oil, driving it underground to nearby producing wells.

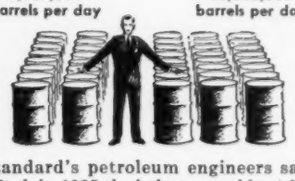
MANY INACTIVE WELLS STILL HAVE LOTS OF OIL left underground in spite of the industry's great advances in oil recovery. Our country must have this oil to meet the growing power needs of industry, the Armed Forces and motorists. That's why Standard is trying a new conservation experiment called "fire flooding."

We ignite some of the oil in a pool . . . control burning by regulating the air supply. Heat and pressure drive the oil to surrounding wells for pumping. It will take more than a year's time and a million dollars to see if fire flooding works. It's worth the effort because it could add more to U.S. underground oil reserves than the discovery of an entire new oil field.

Progress in the West means...

Helping find new sources of oil to supply the 13 million barrels per day the U.S. will need in 1966

1956	1966
8,827,000 barrels per day	13,000,000 barrels per day



Standard's petroleum engineers say, "Back in 1925 the industry could predict only about 20% recovery from a new field. Modern secondary recovery methods, of which fire flooding is one of the latest, could more than double recovery."

STANDARD OIL COMPANY OF CALIFORNIA

plans ahead to serve you better

International Paints for the OIL INDUSTRY

Compañía Shell de Venezuela Ltd.,
Crude Distillation Unit No. 2, Cardón Refinery.
(A Shell Photograph)

When it comes to paints for the oil and petro-chemical industries, experience counts. Experience of the particular problems that are met; experience in the formulation of paints to overcome just those problems. International supply paints to most of the leading oil companies. They have done so for years, and the experience they have acquired is yours to draw on when next it comes to paint.

International Paints Ltd.

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New engineering services on the international scene

BADGER facilities for serving the petroleum and chemical industries continue expanding!

BADGER-COMPRIMO N.V., a new company owned jointly by Badger Manufacturing Company and Comprimo N.V., has been established in The Hague. With a well-integrated staff drawn from the widely experienced Comprimo N.V. and Badger organizations, the firm is now prepared to provide full engineering, procurement and construction services in Europe and abroad.

With three domestic offices — including one in Houston just opened — and its autonomous new European affiliate, Badger services are more than ever on the international scene.

There are reasons for Badger's healthy growth — reasons that are of significant advantage to projects *you* are planning.

Write or wire today for the full story.

COMPRIMO N V

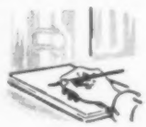
TEXAS — IN EUROPE: BADGER-COMPRIMO N. V. THE HAGUE

THE FULLEST MEASURE OF SERVICE

Our company has often been called the leading independent petroleum research organization. This may be true, as far as it goes, but it falls far short of a true description of our function in the great petroleum industry. In the broad sense, UOP is a *service* organization operating on the basic objective of improving petroleum refining technology in order to help any refiner better his operating and economic position by producing a larger volume of higher quality petroleum products from each barrel of oil he processes. The attainment of this objective encompasses a wide field of endeavor.

It all starts in our laboratories. Here, in an ideal research atmosphere, scientists and technicians search out that elusive new idea that will provide a better and more efficient refining process or method.

We may follow many unfruitful paths and carry out diverse experiments until we find a promising approach. Then it is analyzed and evaluated by UOP's top-flight group of scientists and engineers. This expert consideration determines the practical importance of the theory. This application is then carefully developed in exhaustive pilot plant investigations. Standard facilities are maintained for this or special ones developed as necessary. These pilot plant studies also give helpful design data and cost information on plant construction and product manufacture. When proved, the new process becomes available for license by any refiner, anywhere.



We realize fully our responsibility to provide the licensee with the pattern to make UOP processes work in practical commercial operation. Our process engineers, our designers and other technical specialists render a complete detailed design of the commercial process unit.

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TO THE OIL REFINING INDUSTRY

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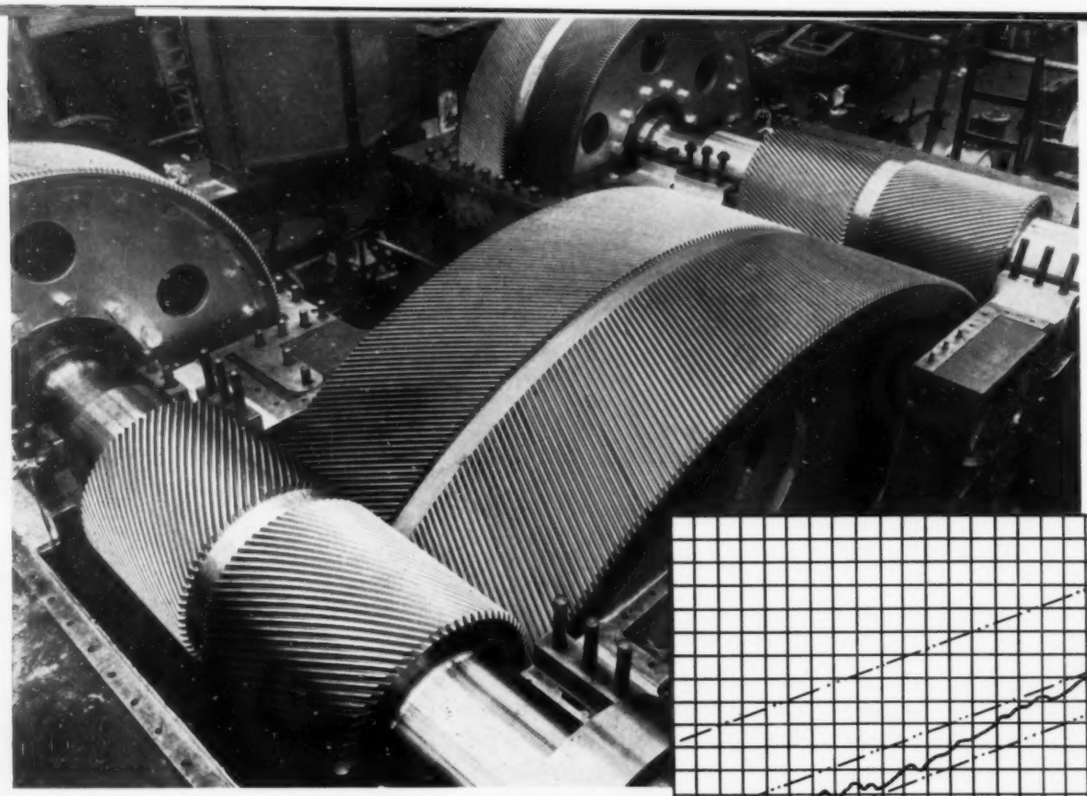

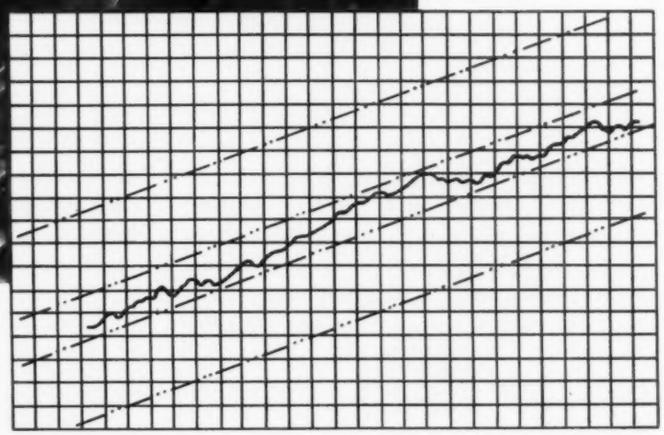

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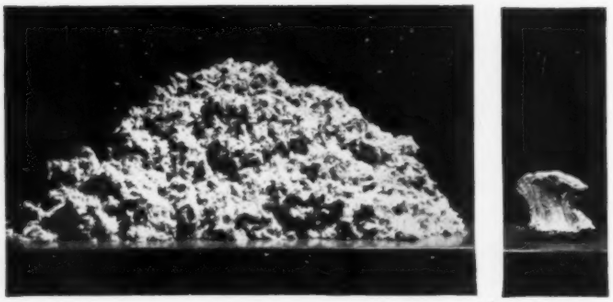

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THERMAL CONDUCTIVITY K = B.Th.U. in. /sq. ft. /hr. /in. /°F.			0.43			0.47			0.53		
MEAN TEMPERATURE °F.			250			350			450		
Nominal Pipe Size	O.D. pipe	Thickness of Insulation	Heat Loss B.Th.U. sq. ft. hr.	Effic. %	Surface Temp. °F.	Heat Loss B.Th.U. sq. ft. hr.	Effic. %	Surface Temp. °F.	Heat Loss B.Th.U. sq. ft. hr.	Effic. %	Surface Temp. °F.
6"	6¼"	1"	135	87·7	126	233	90·6	167	354	92·5	218
		1½"	102	90·8	107	177	92·9	135	270	94·3	171
		2"	83·6	92·4	97	145	94·1	118	223	95·3	145
		2½"	71·8	93·5	91	125	95·0	107	192	96·0	128
		3"	63·5	94·2	86	110	95·5	100	170	96·4	117
		3½"	57·3	94·8	83	100	96·0	95	154	96·7	109
		4"	52·6	95·2	81	91·7	96·3	91	142	97·0	103
8"	8⅝"	1"	130	88·0	127	225	90·8	169	341	92·7	222
		1½"	97·7	91·0	108	169	93·1	137	258	94·5	174
		2"	79·2	92·7	98	138	94·4	120	211	95·5	148
		2½"	67·4	93·8	92	117	95·2	109	180	96·1	131
		3"	59·2	94·6	87	103	95·8	102	159	96·6	120
		3½"	53·2	95·1	84	92·7	96·2	96	143	96·9	111
		4"	48·5	95·6	82	84·6	96·5	92	131	97·2	105

These figures are compiled from results of official tests by THE NATIONAL PHYSICAL LABORATORY, TEDDINGTON, computed in accordance with formulae shown in BRITISH STANDARD SPECIFICATION appendices.

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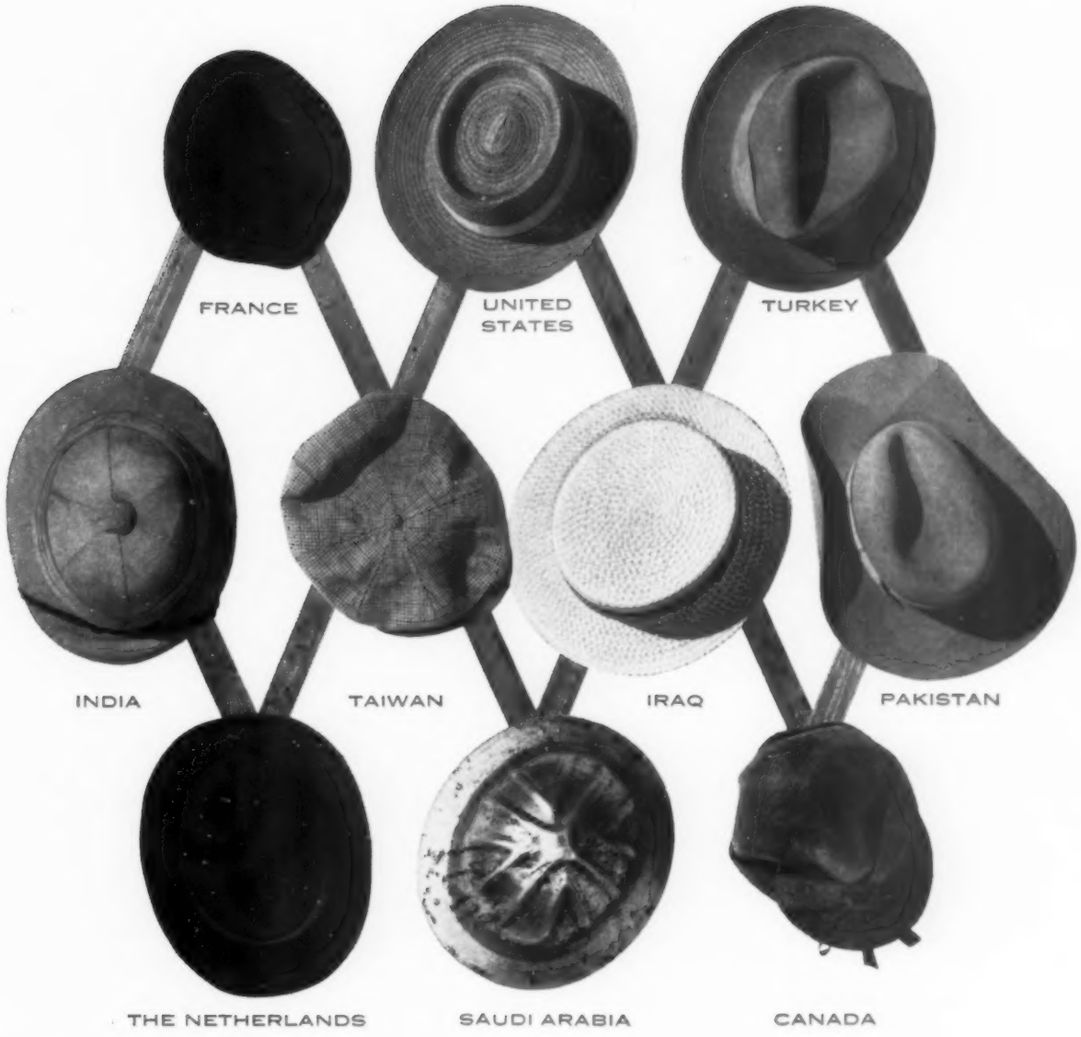

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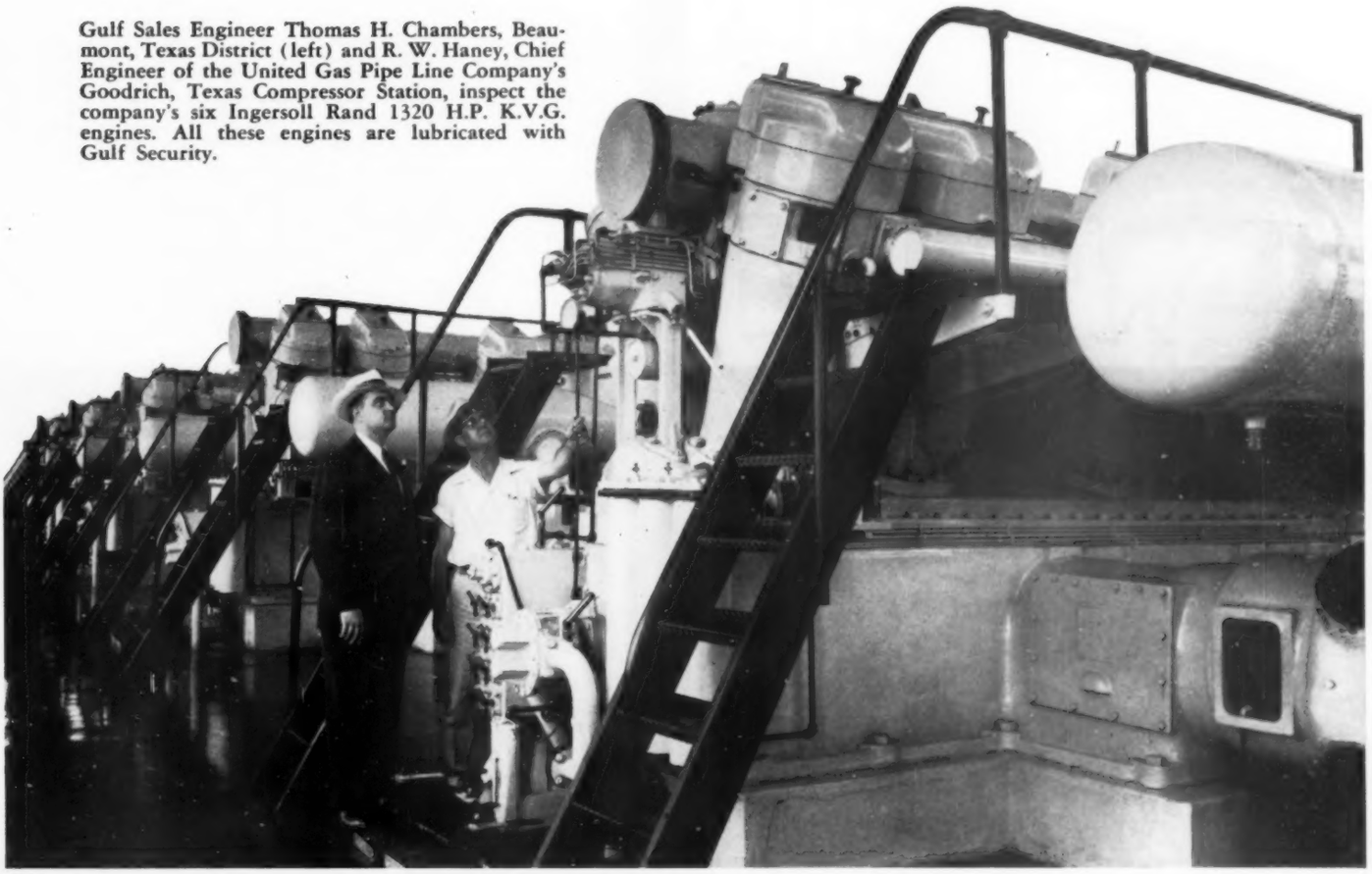

Gulf Sales Engineer Thomas H. Chambers, Beaumont, Texas District (left) and R. W. Haney, Chief Engineer of the United Gas Pipe Line Company's Goodrich, Texas Compressor Station, inspect the company's six Ingersoll Rand 1320 H.P. K.V.G. engines. All these engines are lubricated with Gulf Security.

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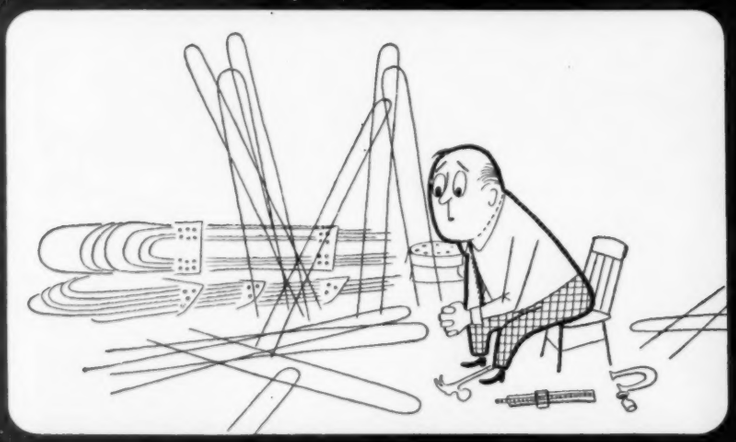
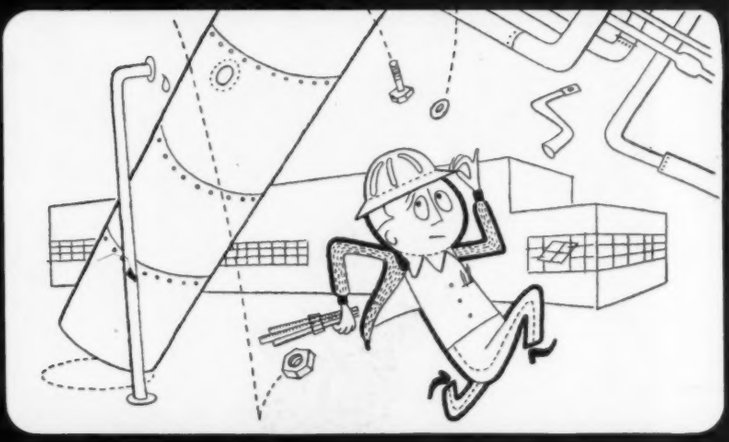


SURE YOU HAVE GOOD ENGINEERS – BUT NOW THEY MUST COPE WITH UNFAMILIAR PROBLEMS.



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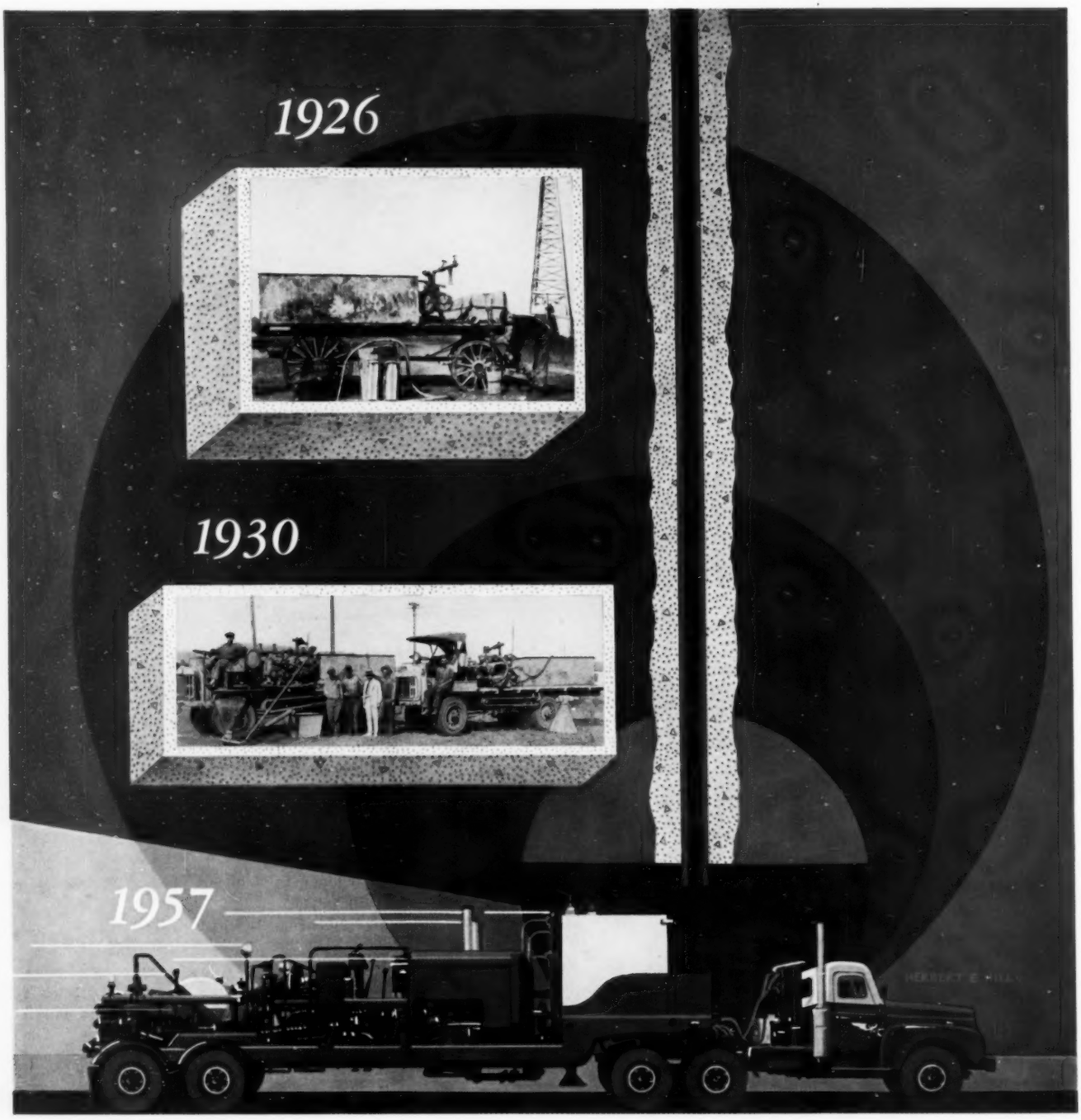
THIS MONTH'S COVER

Brilliant sunshine of the Arabian desert produce a zebra pattern of strong shadows under flowlines in the Abqaiq field. The photograph is reproduced through the courtesy of Arabian American Oil Co. Design by Gloria Sobelman.



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Surplus Capacity—A Necessity

AT no time during the past 35 years has there been a deficiency in the supply of petroleum available for world markets. Throughout the whole period since the early days following World War I, the industry had at its command plenty of oil to meet the world's rapidly mounting energy needs created by the constant rise in the standard of living of peoples in both hemispheres.

Although there has been plenty of oil available, it has not always been at the right place and at the right time to meet unexpected emergencies. Submarine warfare, unusually cold weather, and governmental interference with the free flow of commerce have created temporary emergencies. The present emergency through which the industry has been passing is particularly severe, and a contemplation of the industry's future suggests that similar emergencies in the future may have an even greater impact than have those of the past.

In 1955 the world demand for petroleum outside the Soviet orbit averaged 14,280,000 barrels daily. By 1960 it is anticipated that requirements will rise to 18,700,000 barrels daily, and five years later it should reach the somewhat staggering total of 24,800,000 barrels daily, an increase of 73.7% over 1955. These figures are calculations of the Chase Manhattan Bank, and are generally thought to be on the conservative side as have been the predictions of most economists in past years.

Since the transportation facilities of the petroleum industry were fully occupied even before the Suez crisis, it must be assumed that the industry is faced with providing an increase of 73.7% in capacity by 1965, as a minimum. Any assumption that a capacity increase of 73.7% by 1965 will be adequate, however, is sure to be very wide of the mark.

United States producers have done a tremendous job of finding new oil and keeping reserves at a fairly comfortable level, but the going it getting more difficult. Geophysicists and geologists have combed and recombed most of the promising petroleferous areas onshore in the USA. We do have the continental shelf, which is relatively unexplored, but this is an expensive area in which to operate and maximum production cannot be expected overnight. There are few who are prepared to suggest that US fields can produce 4,500,000 barrels per day more in 1965 than was produced in 1955.

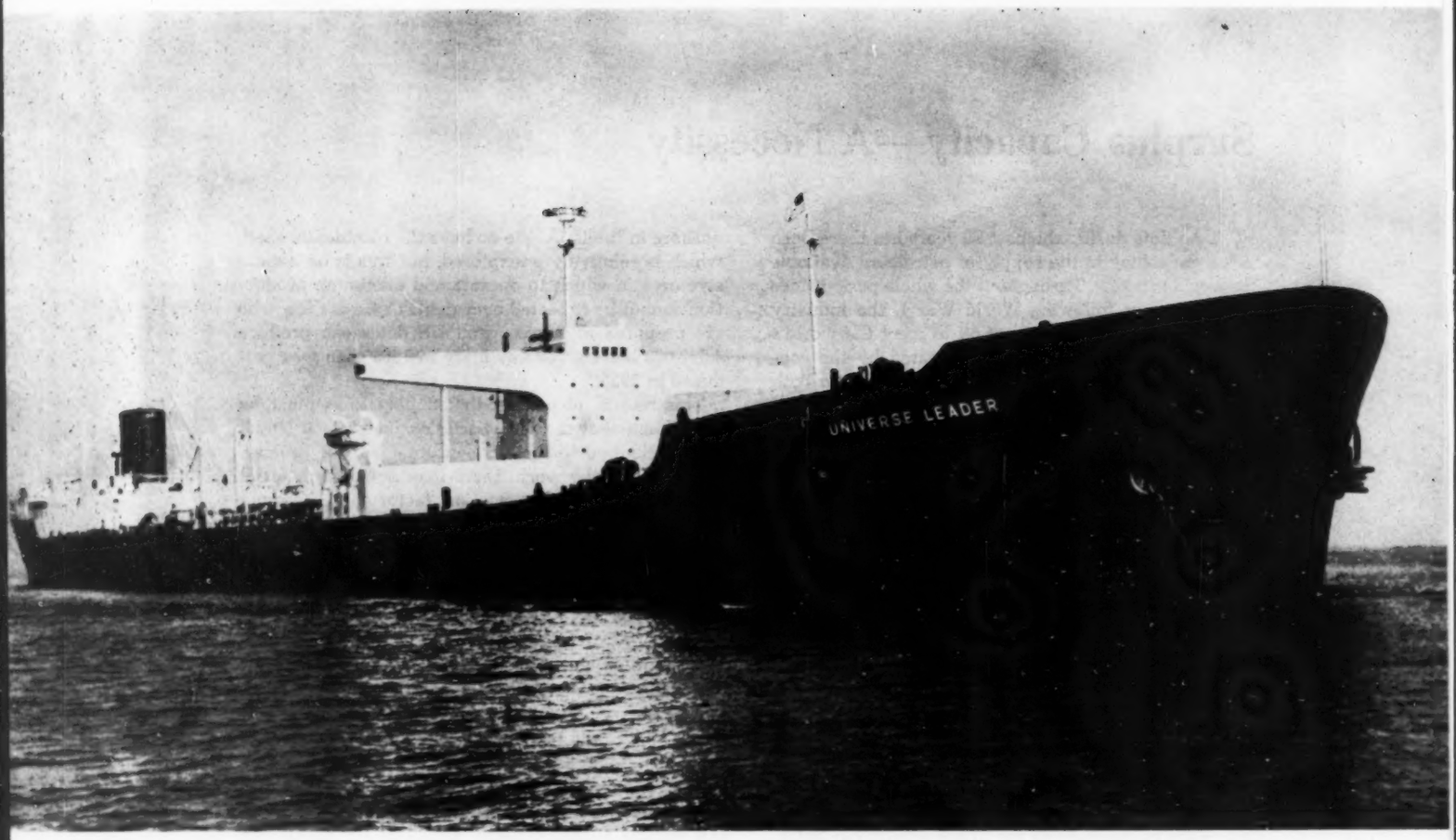
This means, of course, that supply lines must be longer and that the transportation factor in a barrel of oil delivered to the US consumer will be greater. Elsewhere in the world there may not be a material increase in the transportation factor under normal trade conditions.

Obviously, we cannot assume that trade conditions will be normal in future years any more than they have been this past year. Due to the political unrest in the world, old crises may flare up again and new crises develop.

To prepare for such eventualities, the petroleum industry needs a transportation cushion as much as it needs a crude reserve cushion on which it can draw. Part of the job can be accomplished by the expensive method of increasing storage capacity at point of consumption, but the remainder of the task must be assigned to building alternate pipeline facilities and surplus tanker capacity available for operations over longer-than-normal routes when necessary.

The National Petroleum Council of the United States has made a good start in the direction of surveying tanker capacity now available and to become available. This study should be amplified to embrace all means of transportation on a global basis. The study must, of course, be tied in with demand projections by areas and anticipated supply sources. The study is one which can best be undertaken on an international basis through the cooperation of oil and shipping interests in both eastern and western hemispheres. Only if the problem is systematically approached can the industry be certain that it is prepared to have the right amount of oil at the right place and the right time in the future.—END

WORLD TANKER



The largest tanker in commission is the 85,515 dwt "Universe Leader," owned by Universe Tankships, Inc.

Shipyards around the world are busy, with orders already taken which will keep them busy through 1961, conservatively speaking. During 1956 this rapid rate of increase was maintained and this year the pace is even faster. The trend toward "super" tankers has been replaced by one toward "mammoth" tankers, over the 40,000 dwt class. An indication is contained in the comparison of average size; 1957 tankers building are twice as large as those in service. New innovations are taking place as well, especially in motor and anti-corrosion design.

FLEET RISES 8.1%

On December 31, 1956, the world's tanker number and tonnage of vessels of above 2,000 dwt (according to John I. Jacobs & Co. Ltd.) was 2,862 vessels = 44,377,344 dwt. This compares with 2,732 vessels = 41,030,812 dwt. The same time last year, a net increase of 130 vessels and 3,346,532 dwt, which is more than 1½ times the increase over 1954.

The average size of vessels has increased by about 500 dwt each, showing the tendency for increase in size of tankers. This is shown more clearly in new construction.

WORLD TANKER FLEET

Year	*Vessels*	*dwt.*	*Average dwt.*
1955	2,732	41,030,812	15,018
1956	2,862	44,377,344	15,506
	New Building and Orders		
1957	339 motor	7,114,432	21,013
1957	567 turbine	20,143,417	35,526
Total	906 vessels	27,266,949	30,096

The above figures show the marked tendency to increase in size of tankers, particularly in the case of the steam turbine vessels. The size of diesel-driven tankers is also increasing; the makers of these engines, particularly on the European continent, are paying more attention to the development of larger diesel-power units for use in the larger-sized tankers. In France, orders have been placed for 3 diesel tankers of 46,500 dwt capacity, which are the largest such vessels so far projected. A total of some 36 diesel tankers of over 30,000 dwt are to be built, the largest number in Sweden.

Engines of most of these new motor tankers are being built to run on high-viscosity boiler fuel, and a large number of the older diesel tankers have been converted for this use. Formerly, there was a considerable amount of prejudice against the use of this heavy fuel, but little of that remains. It would appear that, where trouble has been experienced in this respect and where the antipathy to the use of heavy fuel still remains, it can be traced to type or make of engine. Modern methods of centrifugal purification of heavy fuel oil have also assisted in popularizing its use in diesel engines.

These larger diesel engines are developing up to 20,000 sph to 22,000 sph, which in some cases gives a rated speed of 17 knots to the vessel, although the general rated speed for diesel tankers is about 15 knots.

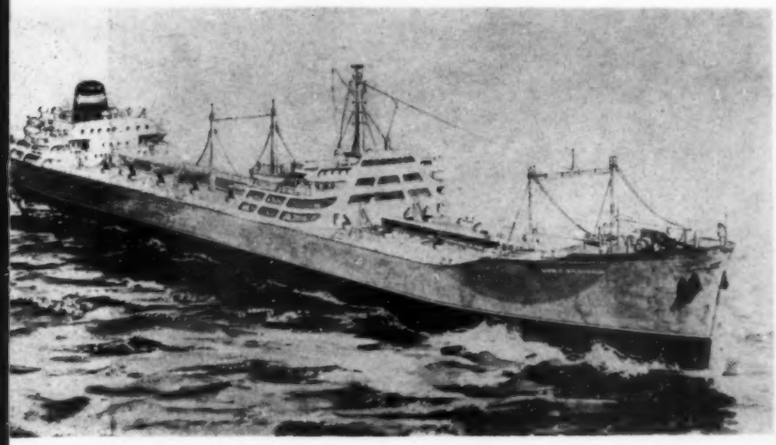
These larger diesel-driven tankers present no great new problems as to berthing facilities, as do the larger turbine vessels, but the propelling machinery is naturally more complicated.

The increase in size of tankers has been more marked in the turbine class. At the end of 1955 the average deadweight tonnage of new-order and building turbine vessels was 30,848, but this had increased at the end of 1956 to 35,526. This very rapid increase has been affected by the Suez crisis which, as mentioned before, has impressed on oil carriers the advisability of making preparations to establish the long haul around the Cape of Good Hope for Persian Gulf crude oil.

Prior to this crisis the oil companies had, in the main, envisaged a 40,000 dwt tanker as the largest vessel which could conveniently pass fully loaded through the canal, when the Suez Canal Co.'s development program had been carried out. Orders had been placed for vessels of this size; but these have been replaced, during the latter part of 1956, by orders for vessels up to 65,000 dwt.

The largest tanker in commission is the 85,515 dwt "Universe Leader," owned by Universe Tankships Inc. The largest one to be built in Europe is the "Spyros Niar-

"World Splendour," 39,000 dwt, the largest tanker launched in Scandinavia.



"Shell Welder," coastal tanker, has compartments "2" and "3" fitted with "Guardion" cathodic protection.

chos," both vessels having loaded at Mina-al-Ahmadi with Kuwait oil.

The "Spyros Niarchos" seems to be the much faster vessel of the two, and was the first ship to arrive in Western Europe, by the cape route, after the blocking of the canal. She covered the 11,373 miles from the Persian Gulf, round the cape to Berre, near Marseilles, in 27 days 17 hours, 48 minutes—achieving an average speed of 17.34 knots, carrying a full cargo of 47,122 tons of crude oil.

The largest tanker built in the USA is the 46,000 dwt "World Beauty" which was launched by Madeline Carroll on January 21, 1956. The vessel was built at the Bethlehem Steel Co.'s Quincy shipyard to the order of the Niarchos group. At the lunch following the launch, it was announced that the Niarchos group had placed an order with Bethlehem for a 106,500 dwt tanker to be delivered in 1959. This new tanker will be some 940 ft long, with a beam of 134 ft and a draft of 49 ft loaded. She will have twin screws, the turbines generating 43,000 shp, and a guaranteed speed of 18 knots. It has not been the practice previously for tankers to have twin screws; there have been several instances of this in past years, but the fitting of twin screws to the modern new turbine driven tanker is a new departure.

It cannot be disputed that, where these large tankers can be used, the carrying of crude oil is more economical than in the case of smaller vessels. However, there are presently not many discharge ports in the world which can accommodate vessels with a draft of nearly 50 ft and lengths of upwards of 1,000 ft. The essential dry-docking and repair facilities will also need to be provided.

There is also a tendency, particularly in turbine vessels, for increased speed which, to a large extent, is a question of economics. Increase of speed entails increased cost in the propelling machinery; and, while a faster vessel can transport more oil per year than a slower one, this gain in capacity must be balanced against the increased cost.

In addition to the abovementioned Niarchos vessel with a guaranteed speed of 18 knots, the British Tanker Co. has ordered two tankers with the same guaranteed speed. These higher speeds are more readily attained in turbine-driven vessels, and so it is probable that more advance will be made by these than by diesel-driven vessels.

Although little has been heard this year about the use of the gas turbine, fitting out of the Shell Tanker Co.'s turbine-propelled "Auris" is proceeding according to program. Trials on her are due to be carried out this year.

One of the modern innovations in tanker maintenance is the use of cathodic protection against corrosion, both internally and externally. External corrosion, i.e., the external corrosion of the hull by sea and/or fresh water, has for many years been fairly successfully combatted by the use of anti-corrosic paints. Internal corrosion of the cargo-ballast compartments poses a problem of an entirely different nature. It can be divided into two main categories, according to the trade in which the tanker is employed, i.e.:

1. Carrying crude or residual oils, which will deposit a residual film of wax or bitumen, or a mixture of both on the steel work of the compartment.

2. Carrying refined or clear-oil cargoes which do not deposit residual films.

Except in the case of some sulfurous oils, neither the black cargoes nor the white ones are essentially corrosive. However, when cargoes on return journeys are replaced by ballast water—in most cases salty—then corrosion is inevitable, and more so in the clean tanks than in the dirty ones, unless some form of protection is furnished. Generally speaking, this corrosion is not so great on the black cargo ships, as the film of wax-bitumen acts as a partial protectant. The majority of new tankers built in the United Kingdom are fitted for cathodic protection when built, and others have been fitted afterward.

It is estimated that, out of the world fleet of 2,862 tankers, at least 600 (over 20%) are fitted with cathodic protection of one type or another. It is claimed by the advocates of cathodic protection, both users and suppliers, that its installation on oil tankers makes a direct saving in cost of maintenance and also increases the economic life of the ship.

Other ships of over 100,000 dwt are being planned from the same yard; while the Japanese yard which built the "Universe Leader" has 5 further vessels of the same size projected, and also is planning the building of some 100,000 dwt tankers.

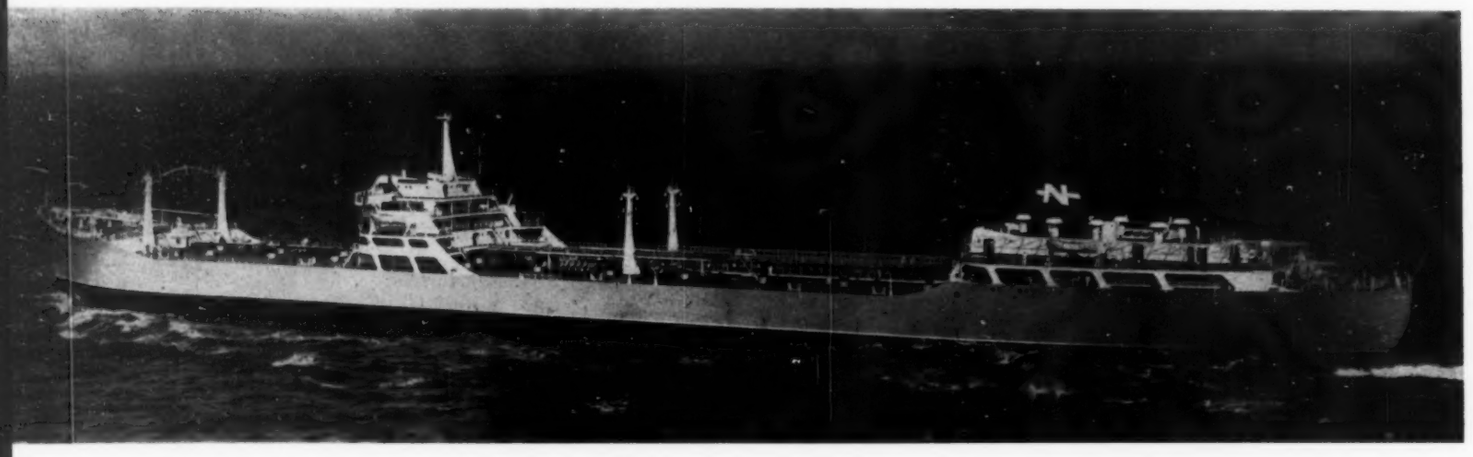
Another innovation which is shortly to make its appearance is a patented method of cleaning a ship's tanks while at sea, without discharge of oily bilge water into the open sea. This consists of a treatment plant which, in addition to separating oil from water, recovers the oil in such a form that it can be used for bunkers. In experiments which have been made, as much as 50 tons of oil has been recovered from one tanker on one voyage and used as fuel. The use of such a plant would comply fully with the act regarding the discharge of oily bilge in coastal waters.

Doubts have been expressed about the strengths of the hulls of some of the larger tankers of the future. British Tankers has endeavored to overcome this in the design of its new 46,000 dwt plus tankers, by dividing the cargo tanks into two center and two wing tanks by through bulkheads, and adding transverse bulkheads for fore and aft stiffening.

There was a large increase in new buildings in 1956 over 1955: motor vessels from 199 vessels = 4,081,295 dwt to 399 = 7,114,-443 dwt and turbine-driven vessels from 364 = 11,228,590 dwt to 567 vessels = 20,143,417 dwt. As mentioned before, average size of both types of vessels increased.

In 1955 the number of vessels on order or building for various oil companies was 162 = 4,691,890 dwt. For tramp carriers or independents, it was 407 = 10,695,195 dwt. In 1956, orders increased substantially both for oil-company vessels and independents; these were respectively 229 = 7,295,940 dwt,

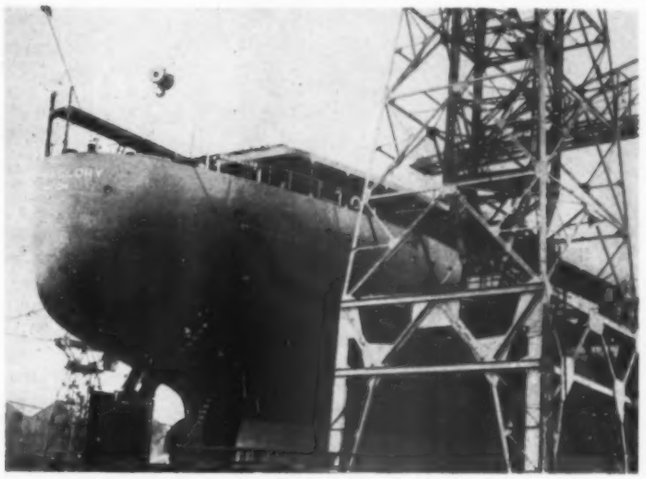
The largest tanker built in Great Britain to date, the "Spyros Niarchos," is shown on her initial test run, May 1956. (Photo courtesy of World Tankers Corp.)



WORLD TANKER FLEET—2,000 DWT AND OVER

	December 31, 1956			December 31, 1955		
	Number	Total Dwt	%	Number	Total Dwt	%
USA	505	7,954,985	17.92	520	8,130,035	19.81
BRITISH	555	7,823,750	17.62	537	7,479,279	18.23
NORWEGIAN	407	6,663,681	15.01	399	6,295,372	15.34
LIBERIAN	253	5,827,201	13.12	185	4,104,598	10.00
PANAMANIAN	176	3,160,556	7.12	184	3,167,043	7.72
FRENCH	118	2,002,295	4.51	114	1,881,538	4.59
ITALIAN	125	1,897,802	4.28	119	1,770,467	4.32
DUTCH	122	1,514,043	3.41	115	1,376,447	3.36
SWEDISH	83	1,348,534	3.04	77	1,240,534	3.02
JAPANESE	63	1,085,749	2.45	57	944,716	2.30
DANISH	49	835,133	1.88	47	769,293	1.92
RUSSIAN	63	572,816	1.29	43	361,316	.88
GERMAN	35	483,773	1.09	33	413,621	1.01
ARGENTINIAN	47	443,212	1.00	46	435,307	1.06
SPANISH	35	343,439	.77	32	287,379	.70
CANADIAN	46	284,732	.64	46	283,782	.69
GREEK	17	240,278	.54	18	254,622	.62
BRAZILIAN	16	229,800	.52	14	223,800	.55
FINNISH	15	214,140	.48	14	196,915	.48
HONDURAN	10	211,965	.48	11	226,549	.55
VENEZUELAN	29	198,396	.45	32	209,048	.51
MEXICAN	19	184,746	.42	20	194,076	.47
BELGIAN	9	164,714	.37	10	169,509	.41
PORTUGUESE	9	107,932	.24	9	113,132	.28
TURKISH	9	101,337	.23	8	80,311	.20
ISRAELI	4	53,283	.12	2	21,823	.05
CHINESE	3	52,628	.12	3	36,528	.10
SAUDI-ARABIAN	1	46,550	.10	1	46,550	.11
CHILEAN	4	44,300	.10	3	26,447	.06
URUGUAYAN	3	35,580	.08	2	33,230	.08
PERUVIAN	6	27,186	.06	5	23,786	.06
EGYPTIAN	2	25,400	.06	2	25,400	.06
SOUTH AFRICAN	1	24,575	.06	1	24,600	.06
YUGOSLAVIAN	2	21,710	.05	2	21,710	.05
POLISH	2	21,501	.05	3	29,773	.07
AUSTRALIAN	1	17,700	.04	1	17,700	.04
KOREAN	4	16,788	.04	4	16,788	.04
ICELANDIC	1	16,730	.04			
MOROCCAN	2	15,137	.04	2	15,137	.04
INDIAN	1	13,125	.03			
COSTA RICAN	1	12,012	.03	2	22,521	.05
SIAMESE	3	11,159	.03	3	11,159	.03
PAKISTAN	1	9,760	.02	1	9,760	.03
COLOMBIAN	2	7,380	.02	2	7,380	.02
IRISH	1	3,350	.01	1	3,350	.01
NEW ZEALAND	1	3,325	.01	1	3,325	.01
DOMINICAN	1	3,156	.01	1	3,156	.01
	2,862	44,377,344		2,732	41,030,812	

BP Tanker Co.'s 32,000 dwt oil tanker "British Glory" is seen prior to her launching at Barrow, February 1, 1957.



OIL TANKERS UNDER CONSTRUCTION IN THE WORLD
(As of December 31, 1956)

	STEAM		MOTOR		TOTAL	
Country	No.	Tons Gross	No.	Tons Gross	No.	Tons Gross
Great Britain & N. Ireland	41	766,020	22	142,169	63	908,189
Other C'lth	..	..	3	4,930	3	4,930
Belgium	4	55,500	1	12,000	5	67,500
Denmark	1	12,200	2	36,600	3	48,800
Finland	..	.	2	6,400	2	6,400
France	6	173,320	8	113,170	14	286,490
Germany	3	65,000	22	67,535	25	132,535
Italy	13	290,516	6	26,800	19	317,316
Japan	22	537,140	21	156,255	43	693,395
Netherlands	7	125,900	4	53,500	11	179,400
Norway	2	28,800	16	139,504	18	168,304
Portugal	.	..	2	11,150	2	11,150
Spain	..	..	9	71,700	9	71,700
Sweden	4	84,500	15	216,430	19	300,930
United States of America	12	246,060	..	..	12	246,060
Yugoslavia	.	..	1	300	1	300
World Total	115	2,384,956	134	1,058,443	249	3,443,399

Source: Lloyd's Register.

and 677 vessels = 19,971,009 dwt. In 1956 orders increased substantially both for oil-company vessels and independents; these were respectively 229 = 7,295,940 dwt, and 677 vessels = 19,971,009 dwt.

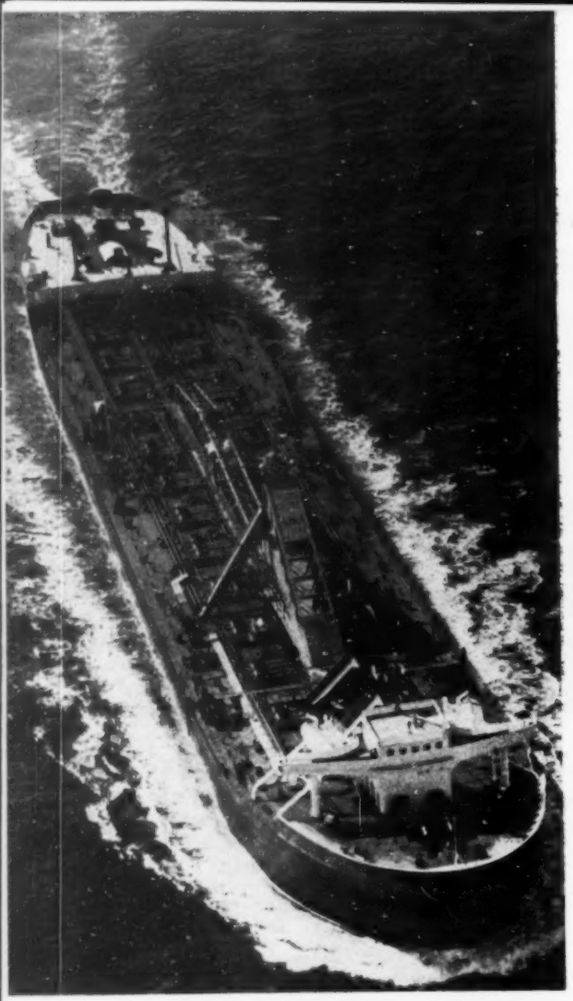
It is somewhat strange that, while the independents have in the main been the pioneers of the mammoth tankers, yet in both years the average size of vessel on order for the oil companies has been higher than that of the tankers ordered by the independent owners. This is probably accounted for by the fact that, in Germany and the Scandinavian countries, independent owners outnumber the oil-company owners to a great extent. Also, their chartering has to be more flexible than in the case of the oil companies, whose ships are self-employed and, therefore, on more direct routes, and are carrying cargoes which can be scheduled for long-time future operations.

In 1955, 71.5% of the vessels building or on order were for account of independents, 28.5% for oil companies' account. In 1956, the percentage to the account of the independents had risen to 75%—showing, on the one hand, that oil freighting is becoming more and more recognized as a profitable shipping line and, on the other hand, relieving the oil industry of capital outlay which can well be employed on other aspects of the industry.

The question of finance for tanker building has become a very important one, as very large sums are required for it. Some of the vessels built in the USA, such as the 46,000 dwt "World Beauty" and the 106,000 dwt tankers to be built by Bethlehem Steel Co.—both belonging to the Niarchos group—are financed by mortgages held by The Chase Manhattan Bank.

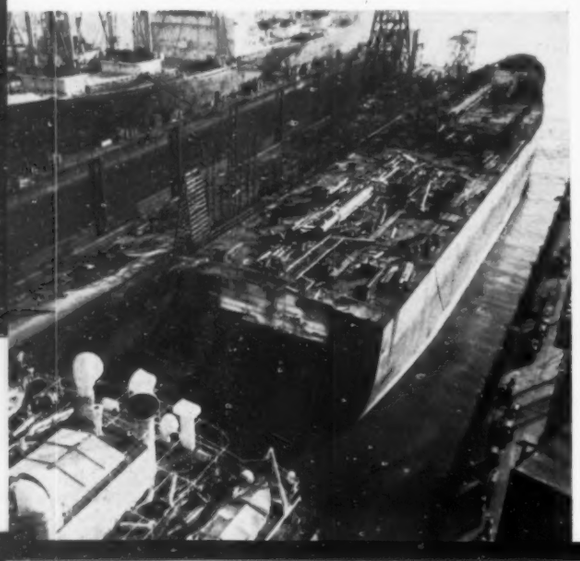
Recently M. Samuel & Co. Ltd. formed a company in London to purchase, over the next 3 years, tankers to the value of £30 million. They arranged, in conjunction with Hoare & Co. and Joseph Sebag & Co., for the new company to borrow £22½ million from a group of insurance companies and £7½ million from Lloyds Bank Ltd. The ships, which are already on order for the Shell groups, are building in British and continental yards, and will be chartered back to "Shell" for periods of 24 years at fixed rates of hire. At the end of this period the ships will revert to Shell. This finance arrangement has received the consent of the Capital Issues Committee.

The independent owners, London & Overseas Freighters Ltd., a member of the Mavrolian group, has raised £7.5 million specifically for tanker construction as a debenture issue. This debenture calls for payment of £20 in allocation; £25, January 1958; £25, January 1959; and the remainder, January 1960. Much more external finance, however, is required to cover payments on the large amount of deadweight tonnage now building or on order. END



The "Sinclair Petrolore" arrived in Delaware Bay, USA, recently with the largest single cargo of crude ever carried by water. The 56,600 dwt ship was loaded with 386,742 bbl of oil destined for the Sinclair Refining Co. refinery. The "Petrolore" is the first ship of major size designed to carry both liquid and dry bulk cargoes, thereby providing substantial economies in transportation costs. She is self-unloading, both as to oil and ore cargoes. The "Petrolore" was built and is owned by Universe Tankships Inc. Sinclair Refining Co. has chartered her for eight years to bring crude oil from Kuwait on the Persian Gulf to Marcus Hook, Pa.

One method for overcoming the world tanker shortage is "jumbo-izing," the marine industry's term for making bigger tankers out of little ones by butting away the stern and bow from the mid-body and welding them to a new, longer, and wider cargo section. Shown is the "Gulfmeadows," owned by Gulf Oil Corp., cut in two with the stern section resting on the bottom of the graving dock and the old mid-body on its way to the scrap heap. A new section was added later—increasing the "Gulfmeadow's" capacity to 20,000 dwt and permitting an additional 30,000 bbl of products to be loaded.



WANTED: 200 SUPERTANKERS of 100,000 DWT OR OVER

The $64,000 question is very small indeed compared with that facing Middle East oil transporters. Should reliance be placed on the Suez Canal — now very uncertain — and on pipelines at the mercy of transit countries? It appears there is little choice; they are all needed, plus doubling of the world tanker fleet in the next 10 years, if Europe's needs are to be supplied.

THE last few months, since the nationalization of the Suez Canal by Nasser, have emphasized the change taking place during the past decade in building and utilization of oil tankers. This is particularly true in relation to the movement of Middle

During the first 9 months of 1956, major oil fields in the Middle East produced over 147 million tons (1,102.5 million barrels) of crude oil. Production in October, i.e., the last month of full production, was about 15.7 million tons (3.8 million b/d) or a rate of about 188 million tons per year (3.75 million b/d). In November, total production of crude was down 46.5% from October levels. In December it rose again to nearly 10 million tons (2.4 million b/d), giving a total for the year of approximately 170 million tons (3.4 million b/d).

The countries which suffered least in this drop were Saudi Arabia and Iran. Iran, a non-Arabian country, has not suffered politically, but production decreased owing to shortage of tankers.

Saudi Arabia had the advantage of an unsabotaged pipeline from Daharan to Sidon. Iran has also not been affected to the same extent as the Arab countries because a large portion of its crude travels eastwards.

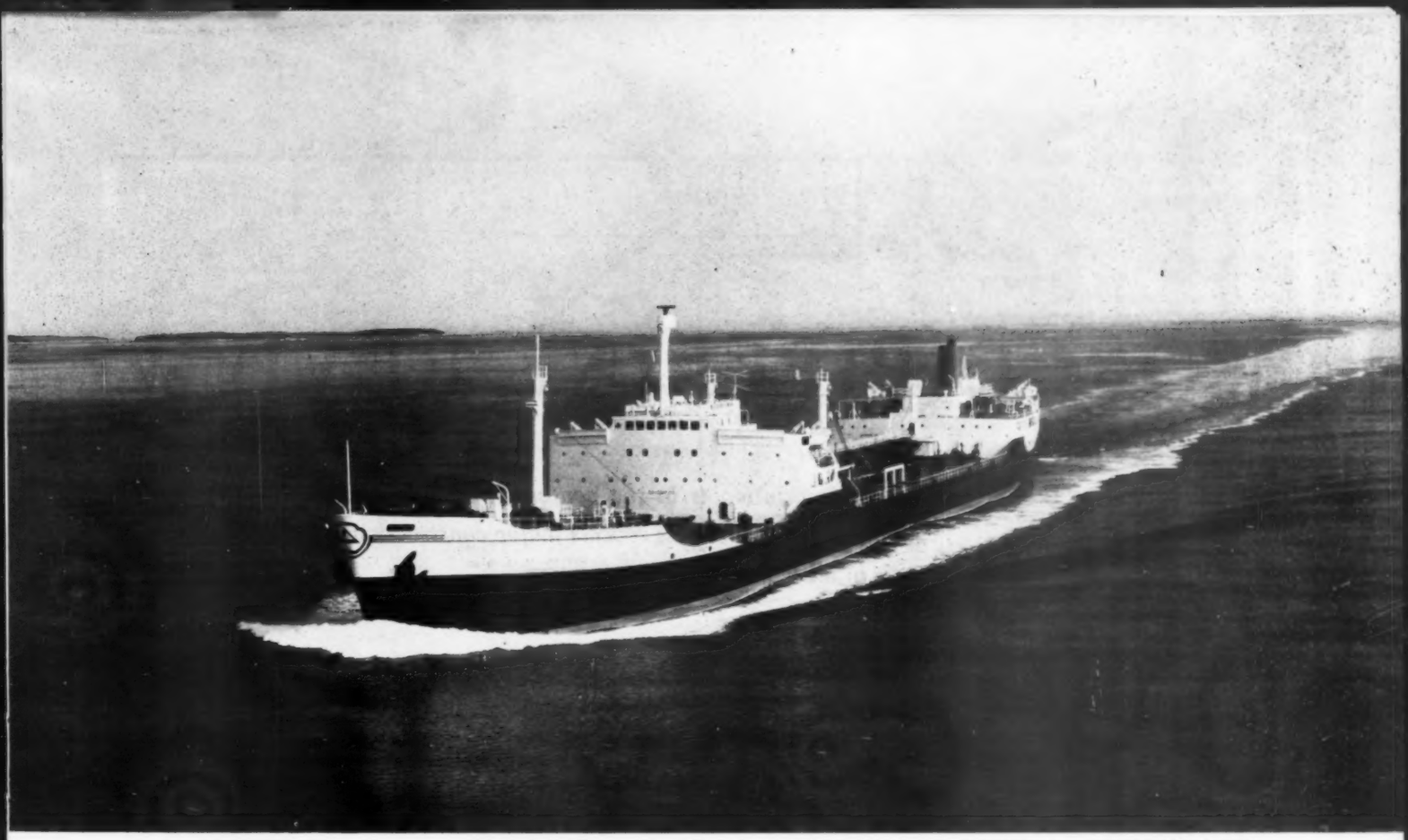
These drops in production for export emphasize the inherent weaknesses of: (1) delivery to seaboard through countries which may become politically hostile to the owners of the pipelines carrying the crude oil, i.e., Syria and the Iraq Petroleum Co.; or (2) those countries which have been using the Suez Canal for the passage of their tankers.

The situation affects Europe much more than any other continent, because Europe has been tied to the production of Middle East crude oil; but other countries, at present self-sufficient in crude, may be deeply involved soon.

The question, therefore, arises whether the international petroleum industry can afford to go ahead only on the present lines, or should wash out any idea of future extension of pipelines and any extension of Suez Canal facilities but rather push the long haul around the cape with larger and speedier tankers.

Based on Middle East reserves and growing world oil demand for energy, production in the Middle East will double in the next 10 years to about 400 million tons per year, or 8 million b/d. Of this, the major portion will have to be exported.

For purposes of this study, it can be assumed that the present crisis is over and



This is the 32,650-ton tanker "Cities Service Baltimore," built at the Bethlehem's Sparrows Point, Md., shipyard—with two sister ships, "Cities Service Miami" and "Cities Service Norfolk."

that conditions have reverted to normal, i.e., the Iraq pipelines have been repaired and are working to capacity and handling some 22 million tons (440,000 b/d) per year, and Tapline handling 16 million tons per year (320,000 b/d). The canal would handle about 130 million tons per year (2.6 million b/d), with the balance of approximately 20 million tons (400,000 b/d) going farther east or via the cape to the USA.

Present facilities, to a certain extent, could be increased. The Iraq Petroleum Co. had a scheme developed for a new 24-in. pipeline from Homs to Banias which would increase the capacity of their pipeline system by a further 9 million tons per year (180,000 b/d). The company also has done a preliminary survey for a new pipeline to pass through Iraqi and Turkish territory to the Mediterranean. The survey proved this line to be feasible, but did not consider the size, cost, nor its political significance. The fact remains, however, that the potentially increasing production of Iraq Petroleum Co. and Mosul Oil Co. must be carried by long pipelines to reach seaboard.

Tapline's capacity could be raised to 25 million tons per year (500,000 b/d) by the addition of more pumping stations. Under present political conditions, a second line or more lines of equal or greater capacity could also be laid.

With regard to the canal, improvements which the old Suez Canal Co. had in view, i.e., widening and deepening the channel, would have raised its capacity, but this maximum as regards crude oil was assumed to be 170 million tons per year (3.4 million b/d). Maximum size of Suez tanker envisaged was 40,000 dwt. The British Tanker Co., a principal user, had fixed its building program to this figure, but since the crisis has raised it to 65,000 dwt. A tanker of this size could not carry a full cargo through the projected improved canal.

Looking at it in the most optimistic way, it would appear that present facilities or expansions of them could only hope to get some 260 to 280 million tons (5.2 to 5.6 million b/d) of oil to the Mediterranean seaboard yearly—from which it would, of course, have to be carried to its destination by tanker. This leaves some 120 to 140 million tons per year (2.4 to 2.8 million b/d) to be transported farther east or to be carried by the long haul around the cape to Europe or the USA.

A fair estimate for the amount to be transported farther east would be 30 million tons yearly (600,000 b/d), i.e., about twice the quantity going in that direction at present. This leaves at least 90 to 110 million tons per year (1.8 to 2.2 million b/d) for the long haul.

Recently the "Spyros Niarchos," one of the fastest of the new supertankers, made the journey from the Persian Gulf to Berre, near Marseilles, in 27 days, 17 hours, 18 min, at an average speed of 17.34 knots. It can be assumed 60 days would be the average time taken for a normal return voyage; allowing for emergencies and repairs, 5 full voyages per year can be assumed. On this assumption, a 100,000 dwt tanker would handle half a million tons of crude per year (10,000 b/d). It follows that some two hundred 100,000 dwt tankers would be required for the long haul alone —and a proportionately larger number if the maximum sized tanker was less than 100,000 dwt. This estimate presumes political, racial, and religious differences will be ironed out.

Since pipelines are extremely vulnerable, it leads to the conclusion that pipelines should, if possible, never traverse nations not directly interested in their safety. Neither can absolute reliance be placed on the availability of Suez at all times.

(Continued on page 55)

WORLD PIPELINE REVIEW

Oil transportation is in the center of the world stage. This review of world pipeline facilities reveals major construction programs are under way in all major producing centers.

At the bottom of practically every major oil crisis that has arisen in recent years lies the transportation problem. This was true during World War II and Korea; hardly less true when the Iranian government was attempting to market its oil during the nationalization period; and certainly true today in the aftermath of the Suez Nationalization.

The basic reason is, of course, the accelerating rate of oil consumption which, with the unhandy placement of oil supplies generally far away from consuming centers, makes oil the world's largest cargo in international trade and the world's largest transportation headache.

The rate of pipeline expansion planned by the oil industry in the next few years is of major proportions. It is reflected in the demand for pipe, where the books have opened and closed in the U.S. on sales of electric weld large-diameter pipe for all years through 1960. Large-diameter seamless pipe is also sold for a long period, but probably not so far as electric weld, since mills will not commit themselves so far ahead. About 80% of demand is for gas lines and 20% for crude and products lines.

In the following discussion existing pipelines around the world are reviewed and new projects discussed.

MIDDLE EAST

Transportation to supply growing needs of Europe, particularly in view of the Suez crisis, occupies the center of the stage in the Middle East.

There are two principal possibilities for increased pipeline facilities. Aside from additions to existing lines, which will undoubtedly be made, an alternative line may be added soon to carry crude from the Persian Gulf area to the Mediterranean. There are two main possibilities for new lines. The first is a projected major line of probably 500,000 b/d capacity stretching north across Iraq to Turkey and the port of Iskenderun or Alexandria. This line is reportedly under negotiation by Iraq Petroleum Co. at the present time with the government of Turkey. Any such project would have to be accompanied by guarantees on the national level, but Turkey as a staunch Western ally appears a safer bet than the riparian states of the Arab Middle East. This line would probably be joined by another major line, this one stretching south to Mina al Ahmadi. It would carry Kirkuk crude (nearly 500 miles from the Persian Gulf) to the Gulf's waters or, in time of need, it could be reversed to send southern Iraq crude to the Mediterranean via the Kurkuk-Turkey portion.

The Iraq projects appear to have considerable advantage over the other proposal currently being debated, namely construction of a pipeline through Israel. The principal drawback to the Israel-Mediterranean line, which starts at the head of the Gulf of Aqaba, is economic. Any such project presumes that the large tankers now being used would be able to enter the Gulf of Aqaba and to pick up the crude on the Mediterranean end. There are, however, considerable difficulties in this regard, since there are no good harbors on the Mediterranean side of Israel where this pipeline would presumably terminate. It would be necessary to go three to five miles offshore to get the large ships in to the leading lines and the problems of moving personnel in and out, transporting customs papers, loading lines, launch time back and forth, and all the other attendant problems are multiplied by the greater distance.

These and other factors, such as the difficulty of maneuvering in the Gulf, operate to make the operation uneconomic as compared with a straight passage through the Gulf or, in the case of a 70,000 dwt tanker or more, around the Cape of Good Hope.

There is also the political aspect to be considered; the Arab states have boycotted all companies which trade with Israel. This might endanger the concession rights of a producing company which attempted to work with Israel. Israeli spokesmen point out, however, that the Arab boycott is by no means a monolithic facade and that if Nasser is obliged to permit passage of Israeli ships through the canal the effect of the boycott will be lessened.

Iraq

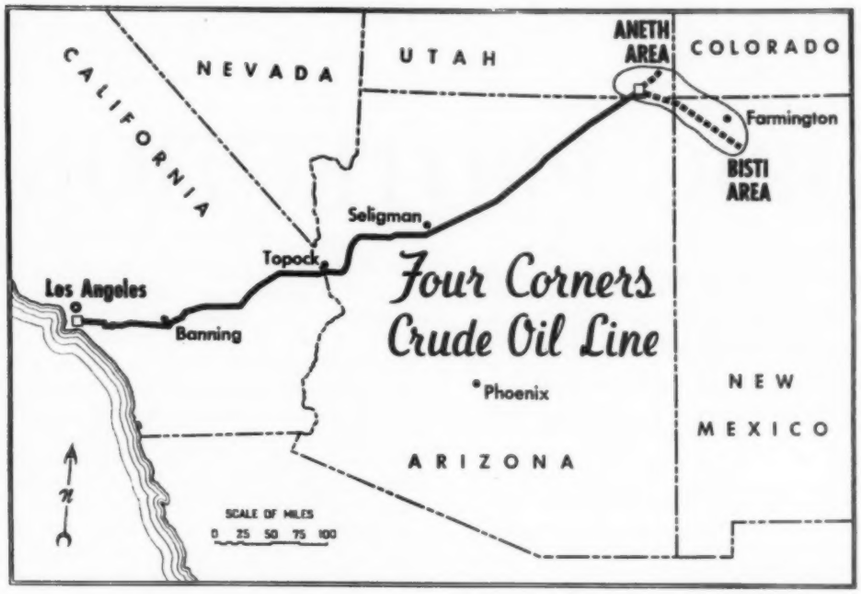
Transporation difficulties long have held back Iraqui production. The first pipelines laid were to Haifa (Israel) and Tripoli (Lebanon)—each with at least 45,000 b/d capacity. The Haifa line was shut down in 1948, and has remained closed because of Arab-Israel hostilities; a parallel line was abandoned in 1948 for the same reason.

However, the increased postwar demand led to a new 16-in. line to Tripoli (completed in 1949), and Kirkuk's production rose to 165,000 b/d by 1951. In April 1952 a 30- to 32-in. line of about 300,000 b/d capacity was completed from Kirkuk to Banias in Syria (cost $120 million)—raising pipeline capacity to more than 460,000 b/d.

A 12-in. line has been laid from the Ain Zalah and Butmah fields in the north to the Kirkuk system, and a 12-in. line extended to the Baghdad refinery. In the south, the Zubair field was connected in 1951 to a 75-mile 12-in. pipeline running to Fao, and in 1954 a 24-in. parallel line was laid with about 125,000 b/d capacity. The Rumaila field was connected by a 12-in. line to Zubair. The Naft Khaneh field is connected with Kermanshah in Iran by a 3-in. line, and a 4- to 8-in. line to Alwand within Iraq—both lines for refining of local consumption.

Kuwait

Transportation in Kuwait is relatively simple, since the Burgan field is located



only 14 to 20 miles from the Persian Gulf. A network of gathering lines connects all fields to the 5,060,000-bbl tank farm at Ahmadi, on a ridge about six miles from the Gulf. From the tank farm, eight lines, vary from 22 to 34 inches feed to the marine terminal at Mina al Ahmadi where eight tankers at a time can be berthed for loading; in addition there are five submarine lines. The capacity of these loading facilities is in excess of one million b/d, the world's largest.

There is no pipeline outlet to the Mediterranean. A line planned in 1948 by Standard of New Jersey, Socony-Vacuum, and Anglo-Iranian (to be called Middle East Pipelines Ltd.) failed of the necessary agreement with Iraq.

Iran

The 10-inch products-pipeline from Abadan to Teheran has been completed ahead of schedule and is in operation. The 300-line section between Ahwaz and Azna, which lies across the Plains of Khuzistan runs through the Kashgan River gorge and rises to a height of some 7,000 feet over the Zagros Mountains. It was built by Costain-John Brown, London, and cost with its pumping stations about £6.5 million ($18.2 million). There was a penalty bonus clause in the agreement from which the contractors made a substantial benefit.

The section of the line from Azna to Teheran was laid by Entrepose, a French firm, and this also was completed ahead of scheduled time. Delay in putting the line into operation was occasioned by the uncompleted storage depot at Shahr Rai, which is not yet ready. The line has an initial capacity of one million tons per annum (20,000 b/d) which can be later increased to 2.4 million (48,000 b/d). Total length is 500 miles.

Neutral Zone

Transportation of the oil was originally by an 8-in. and 10-in. pipeline built by Aminoil 34 miles to a marine terminal at Mena al Ahmadi, in Kuwait. Facilities included a 16-in. 7,600-bbl-per-hour submarine loading line extending about 9,500 ft into 48 ft of water in the Persian Gulf, and 320,000 bbl of storage capacity.

Later a 10-in. line was built from the field to Ras As Zor on the northern coast of the Neutral Zone. A 20-in. submarine loading line is provided, which extends 9,000 ft to 10,000 ft out from shore.

Iran

Soham Sultan Bayat, president of the government's National Iranian Oil Co., recently stated that a $280 million crude line was contemplated from central Iran to Iskenderun in Turkey. The line would have a capacity of 200,000 b/d initially.

Within the Consortium area there are two main sections to the pipeline system. One serves the Lali, Masjid-i-Sulaiman, Naft Safid, and Haft Kel fields to Abadan; the other serves the Agha Jari and Gach Saran fields to Mashur and Abadan. There is also a high-pressure 3-in.-diameter line from the Naft-i-Shah field to the Kermanshah refinery. This is outside the consortium area, and is operated by NIOC.

Israel

Since the Gulf of Aqaba has obtained support from other countries as an international waterway Israel has been building a pipeline from the head of the gulf. The first stop for the 8-in. line is Beersheeba, 140 miles away across rugged territory. This section is now being completed and is expected to be in operation soon. An Israel spokesman said recently that the first tanker should load soon, probably in April. The line will be extended soon by 16-in. pipe to Heletz, and thereafter to the Mediterranean. Source of crude for the line has not been revealed by the Israel government, although some sources have suggested Iranian crude will be used.

Work has also begun on a 54-mile 6-in. products pipeline to Tel Aviv from Haifa. The pipeline will have throughput of over 6,000 b/d of gasoline, kerosine, and gas oil.

Saudi Arabia

There is a pipeline network which centers mainly on Daharan and Qatif junctions. These lines range from 12 in. to 30 in. in diameter, and transport the crude from the junctions to the refinery and marine terminal at Ras Tanura. To the Bahrain refinery go two 12-in. lines, with a total estimated capacity of about 125,000 b/d. The principal line is Tapline, a US $220 million 1,068-mile line from Qatif to Sidon, Lebanon, on the Mediterranean. Capacity is about 320,000 b/d, which can be raised to 500,000 b/d by additional pumping stations.

International Bechtel Inc., pipeline contractors, began construction during 1956 of a $12 million, 22-in. pipeline to connect Safaniya field with Ras Tanura refinery. The distance is 137 miles. Completion date is scheduled for mid-1957, and initial capacity will be 50,000 b/d to 75,000 b/d—later to be increased to 125,000 b/d.

Tapline announced that a 90,000 b/d capacity increase would be installed, with four new pumping stations increasing deliveries to 410,000 by January 1, 1958.

Turkey

Construction of a 450-mile products line of 4-in., 6-in., and 8-in. diameter, began during September 1955. It will run from Iskenderun northeast to Batman for supply to NATO air bases. Two products lines for NATO are being laid by Cia. Technica Internazionale of Milan. One 4-in. line runs 205 miles from Bandirma on the Sea of Marmora to Eskisehir in central Turkey. An 8-in. line runs 250 miles from Antalya to Eskisehir.

A 14-mile pipeline from Raman field to the new Batman refinery has been completed. A second line of 15.5 miles to Garzan fields has also been installed.

Syria & Lebanon

Syria and Lebanon lie on the routes of the great IPC and Saudi Arabian pipelines previously described. There are no other lines of importance at present. The Syrian government is now accepting final bids on a state-owned refinery, which is to utilize two pipelines to transfer oil from ships to docks. Cost of these pipeline facilities is estimated at 1.5 million Syrian pounds.

Egypt

Because production in Egypt is located predominantly near the sea, there are no major crude lines. One products line is now functioning, having gone into operation recently. It is a 12-inch 46,000 b/d black products line that runs from Suez to Cairo. Its cost was $8.4 million.

A proposal for a 120-mile pipeline paralleling the Suez Canal has been advanced

(*Continued on page 68*)

THE TANKER and CATHODIC PROTECTION

Internal protection of tanker cargo-ballast compartments, which has been found highly successful, is now being supplemented by external application of sacrificial anodes which keep hulls virtually corrosion-free. Savings have been attained in dry-docking and paint costs, and fuel consumption is reduced by maintenance of an unpitted hull.

by A. W. Hubbard

THE term "supertanker," and its application to large numbers of vessels now building and in service, mark an era in which carriage costs assume an importance second only to the production costs of petroleum products. In fact, the major justification for vessels of up to 100,000 dwt, now laid down, is their ability to carry more cargo at less cost per ton than their smaller predecessors. In considering costs, it is as well to remember that the tanker carries an enormous overhead in terms of maintenance and renewals. These costs are by no means confined to working components such as the propulsion units, since a large share arises directly from structural-steel work renewals.

In the cargo-ballast compartments, the replacement of the entire bulkheads and stiffeners as a result of severe corrosion damage is commonplace so that, in order to maintain classification, operators, by and large, were forced to accept the enormous expenditure involved as inevitable. Study of the problem has produced various estimates as to this expenditure—it being recognized that the nature of the cargoes carried and other operational considerations have a very considerable influence on the damage which occurs. This has resulted in two main distinctions:

1. The vessel in the dirty trade carrying crude or "black products" which deposit a residual film of wax on the steel work of the compartment.

2. The vessel in the clean trade carrying refined or "white cargoes."

A cost, inclusive of demurrage, totaling £300,000 for a 12,000 dwt vessel operating "white" for 12 years is not considered excessive, and a figure of £120,000 is authoritatively suggested for an 18,000 dwt tankship operating in the "black products" trade for a similar period.

While the second estimate emphasizes that the problem is less costly in the "black" tanker, this is only relative, and the actual expenditure is still sufficient to demand an economical solution. Also, it is as well to remember that many vessels operate periodically in both trades, and actual costs, therefore, are likely to fall somewhere between the two extremes.

There is no doubt that the scale on which cathodic protection has been applied to compartments carrying alternately ballast and cargo places this method of combatting corrosion in a category of its own. For example, the British company which introduced the first patented systems a little more than 4 years ago has now equipped some 250 tankships ranging from short-haul tankers such as the 585 dwt "Shell Welder" to the 47,000 dwt ocean-going "Spyros Niarchos."

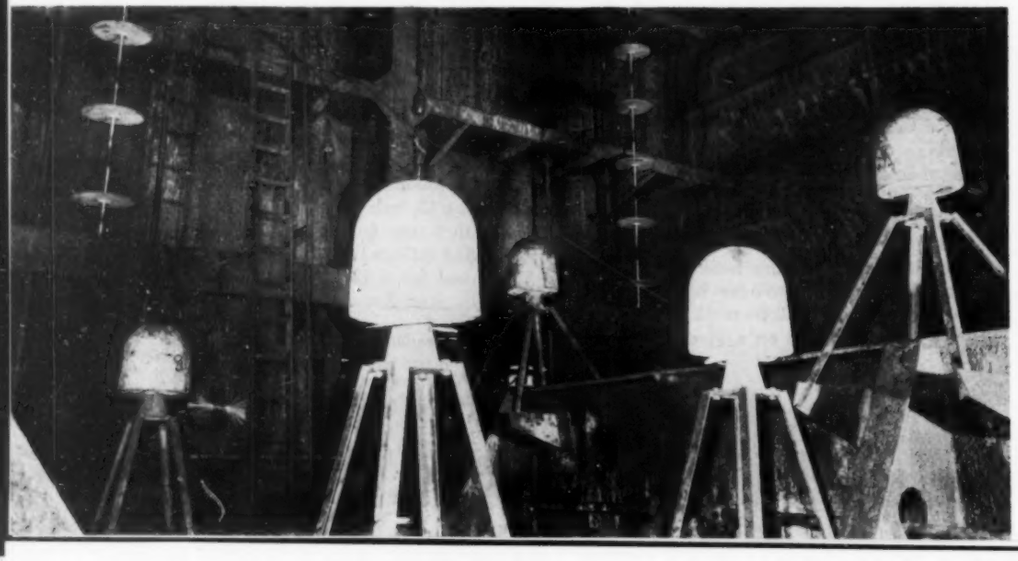
It should be remembered that corrosion is electrochemical. When corrosion occurs, a flow of electric current takes place. In actual fact, local cells similar to the *le clanche* or torch cells, are formed. A multitude of such cells may exist on a metal surface suffering general corrosion. Each will have its own anode and cathode located in a common environment (in the case of a cargo compartment, sea-water ballast forms an excellent electrolyte) and joined metallically by the body of the metal on which they develop. Galvanic cells, or corrosion cells, of this description may equally arise between separate components of metal, providing these are joined metallically and share the same electrolyte. Typical of this is the cargo heating coil which frequently becomes anodic in relationship to the bulkheads and other surrounding steel work of a compartment. Conditions of stress or differences in surface finish may bring about the same effect and, in every instance, the anodic area only corrodes. Thus the logical solution to corrosion, in these circumstances, lies in a measure which will render structural metal completely cathodic. This is the activity of cathodic protection.

To the corrosionist working in the oil fields, the principles of cathodic protection are well-known. For many years it has been common practice to protect buried pipelines, loading jetties, tank bases, and drilling platforms by applying direct electric current to the exposed metal. Many will be familiar with the use of magnesium anodes to provide a source for this current.

Magnesium is inherently anodic to iron and steel (and many other metals too) and, when associated with them in the conditions referred to above, will always be the anode of the galvanic cell so formed. Local corrosion currents are neutralized by this cell and the entire structural surfaces will be rendered cathodic, or noncorroding. The corrosion attack can, in effect, be regarded as having transferred to the magnesium anodes, since in the course of time these are consumed.

Conditions of operation demand a modified approach when considering cathodic protection in tanker cargo compartments. Ballasting is not continuous, and is usually something under 25% of the service life; therefore, provision must also be made to provide some form of protection from corrosion for those periods when the tanks are empty. Perhaps the simplest means of showing how this is achieved is by considering the "Guardion" patented three-stage system for white-oil vessels.

"Guardion" 3-stage scheme in a white-oil compartment: Note the pillar anodes and the two types of booster anodes. (Photo by courtesy of F. A. Hughes & Co. Ltd.).



**Sales manager, F. A. Hughes & Co., Ltd., London.*

A. W. Hubbard is sales manager of the cathodic protection division of F. A. Hughes & Co. Ltd. He was a sales engineer with General Electric Co. Ltd. for a number of years, and it was during this period that he first became interested in the economic aspects of corrosion. He considers that the maxim of all corrosion prevention should be—"How much does it save?" not "How much does it cost?"

In recent years he has written a number of articles on the subject, relating particularly to shipping applications and considers that the time is fast approaching when cathodic protection of ships' hulls and even more so the cargo ballast compartments of tankers, will have to be accepted as standard procedure on economic grounds alone.

This system employs a combination of "main" anodes, of high mass surface area ratio and "boosting" anodes, so called on account of their large surface area-mass ratio which enables them to produce a very high current output for a limited period. Both the quantity of anodes employed and their positioning within the compartment are of the greatest importance. It is, therefore, normal for each protection scheme to be designed to the needs of the individual vessel to insure the best operational results.

On the entry of the salt-water ballast, normal cathodic protection will be established and a current will flow from all the anodes. Initially, the high current density produced by the boosting anodes will have a descaling effect, removing the heavy oxide scale which is normally present in white-oil vessels. Hundreds of tons of scale are frequently removed from large vessels which have seen service, and such scale will not, of course, reform while protection is maintained. This has a number of direct operational advantages which lie in a reduction of the crew's work in removing loose scale during empty passages, simplification of gas-freeing, and maintenance of the designed deadweight. Following this, the strongly adherent film, usually referred to as "calcareous," precipitated from the sea water forms on the steel work. This alkaline film persists throughout the nonballast passages, and will inhibit corrosion during empty periods. Furthermore, it also has an insulating effect, and current requirements to maintain protection are reduced to those forthcoming from the main pillar anodes. Thus, when the "boosting" anodes are consumed after having fulfilled their twofold function, the main anodes are sufficient to continue the protection and maintain the calcareous film until they require renewal—only once every four to six years. The boosting anodes are not again required.

It is worthwhile mentioning that even the rate at which the calcareous film is precipitated is of the utmost importance. Too high a current density will produce a "fluffy" porous film which continually exfoliates and has little protective value. The constant breakdown which occurs creates an excessive maintenance current demand which will ultimately lead to a reduction in the overall level of protection.

Since the efficiency of the protection is linked directly to the ultimate savings in terms of maintenance and renewal costs which are desired, correct design in the first instance is paramount. Although the purchase and installation of arbitrary quantities of magnesium anodes may show an initial saving in capital cost, even a slight loss in efficiency from failure to observe the finer points of design is costly in the long term. Referring back to earlier comments on the cost of corrosion, a scheme of 85% efficiency may effect an all-in saving of £255,000, while one of 75% efficiency will show a saving of £225,000. Thirty thousand pounds sterling is a grave loss for the sake of a few hundred pounds' expenditure at the design and installation stage. Never was there more justification for the role of the cathodic protection specialist and the viewpoint of "not how much does it cost, but how much does it save!"

Similar systems employed in "black" oil vessels require a reduced amount of equipment, since the residual waxy film deposited by the cargo insulates a high proportion of the steel work from attack. The attack which does arise in unprotected compartments is thus confined to areas where this film is about and is, therefore, highly concentrated and damaging. The alkaline condition is far less marked, although overall protection is at least as effective. Extracts from an inspection report concerning the "Esso Exeter," one of the Esso Petroleum Co.'s 26,650 dwt class of turbine tankers which have all been fitted with cathodic protection, are worthy of note:

"Protection commenced with the first ballasting in July 1955, shortly after completion. The inspection was carried out jointly by officials of the Esso Petroleum Co. and representatives of the designers. In all the protected tanks the alkaline film was found to be well defined and possessed a moderate tenacity. When removed at various points to expose the steel work beneath, this was found to be in an excellent state of preservation. The threads of the valve-spindle assemblies were clearcut and in no way impaired; even the lathe marks made on the turned couplings of the valve spindles were as well defined as they were when first made. The steel heating coils, which are particularly vulnerable to corrosion, had received a similar measure of protection. The stringers showed the marked resistance offered by the calcareous film to the corrosive effect of the moisture which had collected on them as a result of excessive condensation at the deckheads.

"By contrast, the unprotected compartments were quite rusted, especially in the region of the tank lids and coamings. Valve chests and spindle assemblies showed active corrosion which was considerably more than surface rust, while the commencement of pitting was visible on certain of the strength members. In an unprotected sister ship, pitting of the heating coils was already in evidence after only six months' service."

The above report is quite typical, to the author's knowledge, of the many protected vessels which have been inspected by independent observers.

Although the cargo-ballast compartments have been a focal point of attention on account of the vast renewal costs involved,

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A section of heating coil in the "Esso Exeter," with alkaline film removed, to show the perfect preservation of the metal following cathodic protection. (Photo by courtesy of Esso Petroleum Co. Ltd.).

Scale dislodged by the action of cathodic protection. (Photo by courtesy of F. A. Hughes & Co. Ltd.).

Pitting attack on the girder in a "black-oil" vessel. (Photo by courtesy of Deutsche Werft).

TRUCK TRENDS: SPECIALIZED

Oil-field hauler: This is one of the big heavy-duty Autocar trucks used for all types of rugged hauling work in the oil fields. These trucks can haul loads up to 200,000 lb, and are used for both off-the-highway and regular highway work. They are available in models with wheel base up to 356 in. and powered by either diesel or gas engines.

New off-road Transporter, which is designed to travel cross-country over rough terrain. Powerful electric motor is geared directly to each individual wheel to provide all-wheel drive. Also, should one wheel lose traction, its share of the machine's total horsepower is instantly transferred to other wheels which are taking hold. The unit can haul a 70,000-lb cargo. Photo courtesy of R. G. LeTourneau Inc., Texas.

For 40 years the petroleum industry has been striving for fully automatic installations to move crude oil from the wells: tions to move crude oil from the wells; gasoline from the refineries; oil products to the ultimate consumer. I read with a great deal of interest that this has now been accomplished in one pilot plant. Naturally, many others will follow.

Similarly, the industry calls for more engineers—better trained. The caliber of technically trained men and scientists engaged in oil-industry research, development, and engineering has been a tremendous factor in the growth record of the industry in recent years.

There you have two major factors which contribute to the growth of the industry: control its destiny—machines and men.

There is a third factor affecting this growth of oil which has not had the same attention, possibly because it does not have as much dramatic appeal. This third factor is mobility—the ability of the industry to keep moving. This mobility dominates the logistics of the petroleum industry.

As the industry has advanced, its activities have become highly specialized and departmentalized. Its scope has become worldwide and, regardless of where you look in the petroleum industry, mobility is a vital concern. About half a million trucks are required in the United States—probably a $100,000 more abroad; and these are being shuffled practically everywhere—even to the heart of the jungles—in the quest for oil.

There is more to mobility than building larger transport units and searching for new means to haul cargo. Truck-design engineers are striving to achieve the same degree of efficiency in motor trucks which the plant men are working toward in building fully automatic plants. Their aim is toward maximum equipment utilization and operating efficiency.

To accomplish these things, truck engineering is taking several interesting turns today. Let us look briefly at developments in a few phases of activity.

The work which a truck is to do in the petroleum industry is more important than ever before, because more is expected of a truck. Loads are getting bigger—both in oil-field service and in transport and marketing of petroleum products. Mileages are higher, regardless of where the truck is to be in services. Even the fuel-oil truck operator is striving to lower the cost of each gallon of fuel oil delivered by extending routes, boosting delivery schedules, and increasing tank capacities to cut operating costs. And in the rugged oil-field end of the business, equipment loads are larger; they must be hauled over worse terrain and on tighter schedules.

With this trend toward bigger and heavier rigs in the oil fields, truck engineers went right along with the oil engineers—right into field research, doing survey work to find out what could be done to provide correct truck application in oil-field service. The answer to utilization and efficiency in many cases, they found, was custom-building of the big trucks to exact load and operating conditions.

Rugged 150,000-lb to 175,000-lb gross combination weight (chassis and load weight) diesel trucks for off-highway service in the oil fields were found advantageous for many operations, but there was a demand for even bigger units.

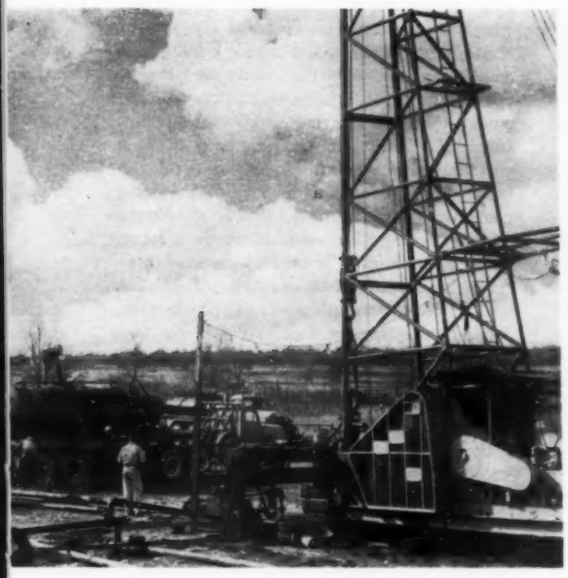
A new giant "big brother" was soon in production, and now is doing yeoman work in the oil fields. It comes with diesel or gas engines running up to 335 hp, and has a wheel base up to 356 in. A giant tandem axle truck, it has the power and strength to take a gross combination weight of 200,000 lb. This husky unit has a 70,000-lb rear-axle bogie and a front axle rated up to a capacity of 25,000 lb.

Designed after discussions with drillers, engineers, and oil-field haulers, it has many features which the users told our engineers they required for a good practical, economical, and dependable hauler. Size isn't the only specification they had. How it performs was mighty important, too.

The big truck is engineered to provide a wide range of gear ratios, supplying power at speeds from just above idling (for rough work in soft terrain or on plank roads) to road speed with a full load. It is built around a brutally-rugged reinforced steel frame, powerful springing, and other features engineered to withstand roughest abuse.

What has been done to the frame is typi-

DESIGN AND BIGGER UNITS



Automotive equipment assembled at a well for a fracturing job: The light workover rig itself is skid-mounted for quick loading on a truck.

Tank capacities have gone up substantially because of creative truck and tank trailer design. This combination features a 90-in.-dimension tractor (front of bumper to back of cab). Special under carriage, with spread tandem rear axles, helps improve weight distribution.

cal of the way truck engineering for oilfield service has advanced. The frame is made up of four longitudinal members. A primary member has a ⅜-in. channel and heat-treated alloy-steel frame 10¾-in. deep. This is supported internally with a 9/32-in channel liner and a ⅜-in.-thick angle fishplate running the full depth of the frame. Outside of all this is a ½-in.-thick fishplate, 18 in. deep with a 3-in. flange on the bottom.

This same degree of creative design has gone into every unit of trucks for this heavy service—axles, transmissions, chassis, and engines. The use of new, stronger metals and design techniques has helped add life to the trucks and reduce downtime. A word should be said, too, about the use of bolted construction using higher-strength heat-treated bolts to withstand the working and weaving produced by road motion. Rugged service has proved that this change added to truck life and lowered maintenance cost.

Functional design of motor trucks today is also of prime importance in achieving maximum equipment utilization and operating efficiency—particularly in transport and marketing of petroleum products on the highway and over city streets. Inches saved in overall length boost payloads and improve maneuverability, thus saving delivery time. Cab-over-engine design is advantageous in many applications, and there is a trend toward this type unit in both straight truck and tractor tank trailer applications. The compact design is important for driving ease, maneuverability, safety, and visibility in traffic and congested areas.

Functional design of motor trucks for the petroleum industry means applying a truck as nearly as possible to the work it is to perform—taking the waste motion, the waste power, and the inefficiency out of the vehicle. For example, the development of the curb-level cab-over-engine type truck saves time and energy for the driver in multiple-stop service such as gasoline or fuel-oil delivery. And, similarly, the shorter front end on modern conventional tractors transforms wasted inches of hood to payload space without adding to the overall length of the vehicle.

Engineers today are approaching each unit of the truck with this functional aim—"How can we make the truck for this specific service more useful, more efficient?"

It may be the use of new metals, new design techniques, new power efficiency, new awareness of the specific needs of the industry for truck application. In all these modern approaches to truck design, the logistics of the petroleum industry is being served more effectively.

Better to accomplish this end, there are ways in which the industry can be of assistance to truck manufacturers in gaining this new efficiency and economy. When there develops a transportation problem, call in qualified transportation engineers to help seek the answer. When a new situation or changed application develops, go over the problem analytically with competent truck engineers.

There is no need in these modern times to buy a truck "off-the-shelf" for a business so technical as the petroleum industry. This matter of "operator-designed" trucks is not just sales talk; it is definitely a sound way of selecting transportation equipment. The complicated highway

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Off-the-shelf trucks for the petroleum industry have made way for customer-designed units built for the specialized job of hauling bulkier and heavier equipment over worse terrain or to save precious inches in meeting traffic congestion or highway regulations.

*By E. W. Schwartz**

* Export Manager, The White Motor Co., Cleveland, Ohio.

PIPELINE PROGRESS

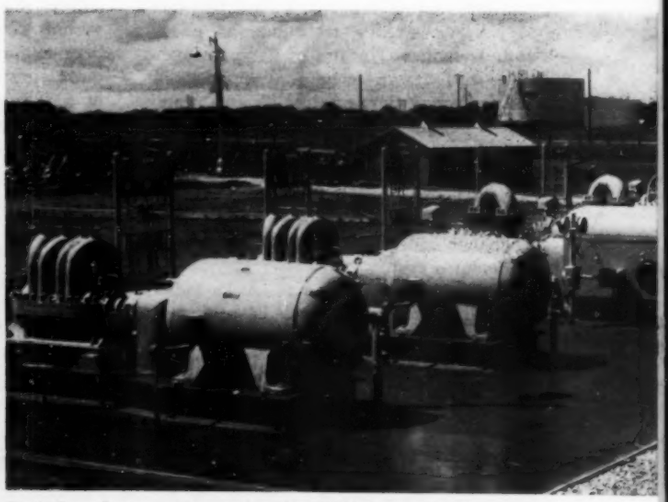
Investment in new pipelines on the North American continent will approximate $1.5 billion in 1957 if pipe is available. Engineering refinements are keeping pace with expansion of the physical plant.

DEVELOPMENTS in pipelining for 1956 saw far-flung applications of the internal-combustion (piston) engine for driving centrifugal pumps and compressors, as well as installations of both gas and diesel engines for powering stations operated either by remote control, or as "satellite" stations which would come on or leave the line in accordance with prearranged throughput conditions. For the first time in several years, more internal-combustion horsepower than electric motor power was installed on crude lines. The percentage of gas-turbine installations on natural-gas trunk lines showed a drop from previous years due, for the most part, to the completion during the year of several large projects involving both new trunks and extensive looping of lines relying largely, if not entirely, on piston-type power for driving compressors.

The trend continues of setting centrifugal compressors between gas pipeline stations equipped with reciprocating units, although officially listed as "experimental" by some of the companies placing such units in service. The relatively low compression ratio obtained in usual centrifugal-station practice does not prohibit such units being used to iron out peak pressure phenomena imposed on the line by incomplete suppression of pulse beats impressed on the throughput by reciprocating compressors.

Upgrading, or stepping up the ratings, on gas turbines in pipeline service continues; and, although the percentage of compressor shaft horsepower remains unchanged, compressor loads being handled are up as much as 50% over those earlier believed to load the turbine. Where regenerative equipment can salvage waste heat

One side-boom tractor cradles this line for cleaning machine (beyond boom) and for the wrapping machine with its twin rolls of tape and asbestos felt, and for the man with the "jeep" checking close behind for possible holidays.



Typical outdoor pumping station, in which the weather protection for the electric motors driving the pumps is built in: All wiring for power and control circuits is buried in conduits, as is all piping except short legs to pump suction and discharge flanges.

from turbine exhausts, the turbine is pressing close on the heels of the internal-combustion engine (supercharged) for thermal efficiency.

Development and introduction of new metals and alloys—especially those exposed to high heat, as in gas turbines and others operating in highly corrosive conditions—extend the service life of units previously requiring frequent shutdown for overhaul and replacement of key parts. In the field of compressor cylinders, for instance, the adaptation of nodular or ductile cast iron enables this material to be employed for cylinder blocks on compressors handling natural gas at pressures in the 2,000-psi range. This metal is now being used where formerly cast-steel cylinders or blocks were specified for this severe service.

Use of extruded aluminum pipe, for both gas- and liquid-carrying service, continues to find short lines being laid under exacting conditions. One such line, utilizing aluminum for the land portions of its system, retained steel pipe for under-water crossings on account of the greater negative buoyancy obtainable without excessive loading of the pipe exterior with weighting material to prevent flotation.

Most of the aluminum pipe being laid is provided with conventional coating and wrapping or is tape-wrapped before being placed in the trench—although one such line was left bare to permit observation of corrosion phenomena as the line ages in service. One of the advantages gained, or at least claimed, for aluminum pipe is that it can be welded by the shielded-arc process at a rate which can overtake the average ditching machine on cross-country pipe laying.

Radioactive materials, principally cobalt 60 in an oil-miscible solution, are being used to determine the progress of interfaces in batch-loaded products lines, and to trigger the operation of automatically operated switching of flow in such systems. Where the counter or actuator is placed contiguous to a station, special shielding precautions are taken to prevent the possibility of radiation absorption by pipeline personnel. Diffusion of the relatively slight quantity of radioactive material throughout the contents of storage tanks is such that the saturation point for human susceptibility or exposure is never even remotely approached.

Other types of interface recorders, functioning through gravity change or other characteristic of the line throughput, are increasingly being used to cut down the amount of mixture shunted into the lower-grade tank, or drawn off to a slop tank for eventual rerun by the refinery.

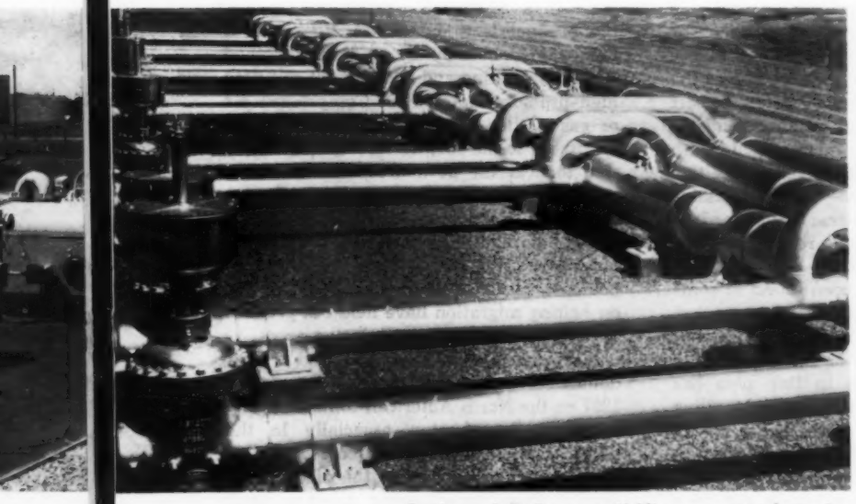
Vibration checks, units capable of detecting incipient vibration buildup, as well as actuating shutdown or relief equipment, are being widely applied to many units in both fluid and gas pipeline installations. These vibration switches, inconspicuous and requiring only a single additional conduit for the instrumentation circuit, can be set to operate at any predetermined value, well below the point at which vibration would become a menace to proper functioning of the unit.

The trend toward removing all outdoor control actuating panels and placing them indoors continues to increase. Stations which formerly had their push-button control group adjacent to the compressor or pump foundation are being revised so that only the simple "Stop" button and its reset are being placed at the equipment, with all other supervisory and control points removed to within the station where their functioning or nonoperation can be observed by the station engineer—or televised or otherwise electronically transmitted to the central control at the dispatcher's console and to other head offices.

Outdoor, all-weather motors are finding increased favor with pipeline management for driving main-line pumps and compressors. They long have been the rule in production and field installations. These motors, designed for effective ventilation under all kinds of weather conditions, eliminate the need for a pump house, and at the same time eliminate the danger of gas pockets and possible explosion or fire. With electronic check of bearing temperatures, lube-oil levels, and other data essential to proper functioning, the outdoor motors require only an occasional visit by the operator to check the screens on the ventilation system, and to wipe off dust from the motor housing.

Corrosion protection of pipelines, now almost universally included in the design of any buried and most aboveground piping, saw the application for the first time in 1956 of polyethylene tape as pipe insulation over more than just a test section. A line of 22-in. gas system, 120 miles in length, was cleaned and tape-wrapped without primer, and with only a loose spiral of 15-lb asbestos felt as cushion and shield during the actual lowering-in and backfiring operations. The tape-wrapped line has been given cathodic protection through the installation of rectifiers and ground beds, and it will be watched by pipeline and coating-materials engineers as its service life develops.

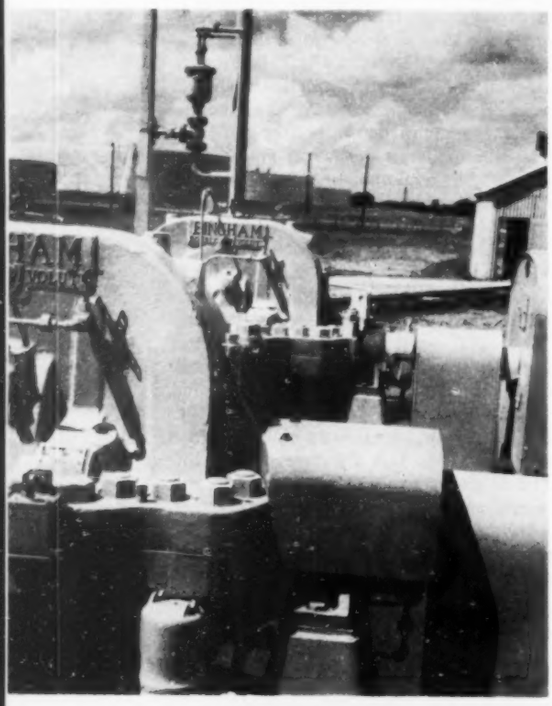
A combination of corrosion protection and weighting for underwater lines—first developed experimentally and announced some two years ago, in which the coating material is extruded around the pipe fol-



Suction and discharge manifolding on a natural-gas pipeline's compressor station, in which a series of "bottles" is ranged alongside the headers—with suction or discharge-stream pulsations suppressed by off-center entry of pipe to each bottle.

Modern suction and discharge leads on a natural-gas compressor station, equipped with automatic actuators for the quarter-turn plug valves: A smaller edition of the actuator also operated the bypass valve.

Carried on a bracket attached to the side of this pump casing, the vibration-actuated switch is out of the way; yet responsive to any increase in vibration of the pump. Reset and "Stop" buttons atop the unit allow it to be used for pump control.



Looking down into an underground storage chamber being cut out of hard rock by mining methods: The walls are covered with wire mesh, held in place by bolted blocks, to prevent rock falls on men at bottom of cut.

lowing the welding sequence on the lay barge—has been given its first extensive marine test, and has demonstrated that the process is practicable. The coating, a compound of barites and asphalt, is applied hot and then water-spray cooled as the pipe passes down the barge ramp. Even when cold the material possesses sufficient flexibility to follow the contours of any and all pipe bending as the line is fed off the stern of the lay barge and forms a progressive reverse bend as the string eventually reaches its bed in the bottom of the underwater trench.

Development of equipment to extrude and compact this coating on pipe after the final welding operation, and the consequent elimination of the need for applying special weld-covering sections of the weighing material, provided a continuous, unbroken cover. This should silence the objection to weld-cover patches in concrete coatings, in which it is felt that complete coverage in all instances is not attained.

The difficulty of obtaining a perfect bond between the precast concrete on the pipe and the added covering over the weld—inherent when precoated pipe is used—is being overcome, experimentally at least. This method utilizes a form or shield which is tightened across the shoulders of the concrete on both sides of the weld, and the form then filled with an asphalt mastic mix which has been proved to adhere strongly to the pipe and to the abutting concrete.

So far, however, no practical method has been developed to eliminate two drawbacks to this method: One is the presence of dust or sand on the surface of the concrete, preventing complete bond. The other is that the change in pipe cover forms a stress-concentration node at the weld area as the pipe is fed from the barge to the trench. It has been demonstrated, from careful checks of line contours, that the concrete weighted length of pipe with its cured cover tends to flex less than does the weld section with its less strongly reinforcing cover. Further, the mastic compound—although hardening if exposed to the air for a sufficient length of time—is apt to remain soft enough to yield somewhat as the patch passes over the under-water support used to control sag. This yielding tends to make the support move momentarily with the pipe and then to snap back to position as the pull on it increases—adding excessive vibration to the other stresses sustained by the pipe before it comes to rest on the bottom. Retention of the metal shield or form around the mastic has been found in some measure to help control, but not to solve, this problem.

Recognition of causes of deformation and resultant stress fatigue in line pipe has brought about greater care in its handling from mill to yard or stringing point. In railroad transportation, for example, it has been found extremely important that care be given to the number of blocks and their spacing for the support of the lowermost tier of pipe in the car. Not only must these blocks sustain the static load of the pipe without causing distortion; they must also distribute the loading set up by the pounding of the car over rough track. This kinetic loading may prove to be several times that of the actual pipe weight alone.

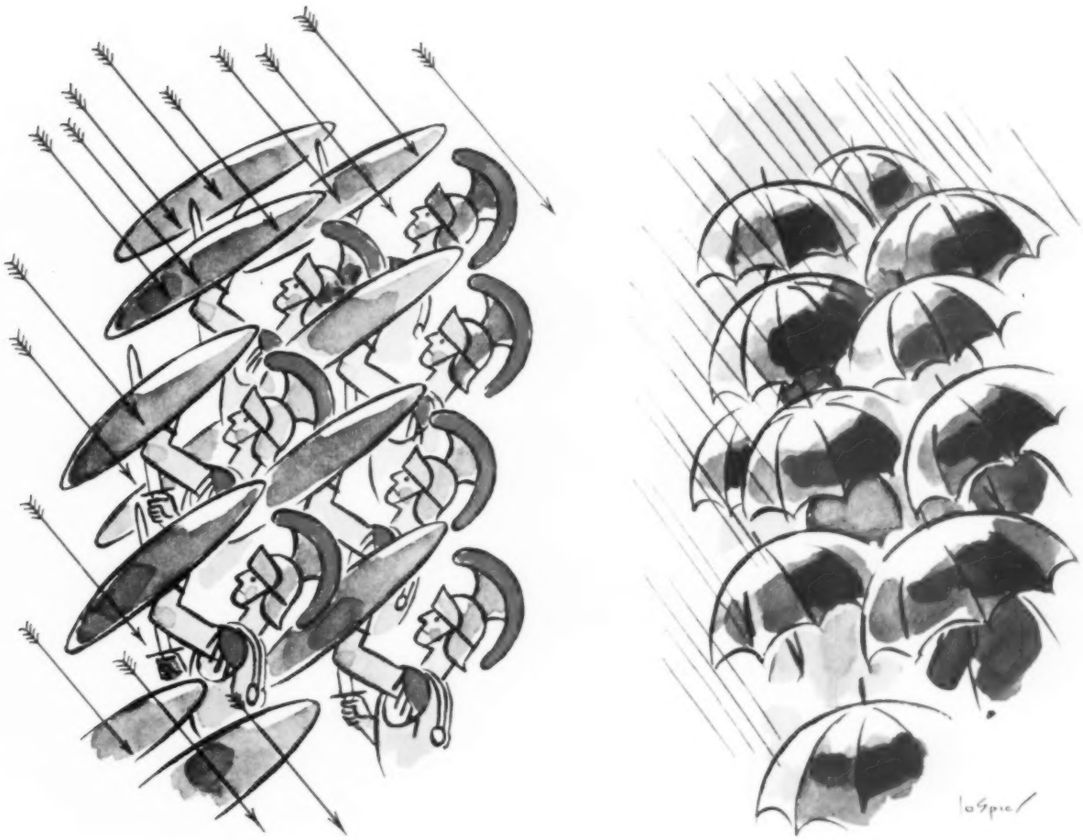
Tow pipelines long enough to justify being so termed, instead of being merely short conduits for short hauls, are now in operation handling solids. Technically, the throughput is not a solid either in the case of the line transporting gilsonite, nor in the coal pipeline. The material must first be finely ground, and then become a slurry through the admixture of water. Inasmuch as the pumpability of a slurry depends, among other factors, on the velocity of the stream through the pipeline system, as the solid matter tends to settle out with a drop below the critical velocity, such pipelines are designed with means for cutting in additional pumping units in case of failure or shutdown of the prime pumps. In the case of one line pumping a slurry, failure of the electrical current to the motors driving the main pumps—or any other stoppage of flow through the line—automatically starts an independent internal-combustion engine, direct-connected to a triplex plunger pump. This standby, or more properly "flushing," unit is of such capacity that the entire line can be washed with clear water within 30 min from the time the unit comes on the line.

Experiments with wetting agents, to insure that each grain of solid becomes the center of a droplet of water, so far have indicated that such a method is feasible but too costly, as yet, to be practicable for lines carrying large volumes of material. Dry piping of materials is being practiced over short hauls only.

The past year has seen the creation of a number of underground containers for storing natural gas, butane, propane, and other hydrocarbons—brought about by an extension of mining technique whereby chambers are hollowed out in a suitable formation at a depth where the rock pressure will more than balance the pressure at which the product is to be stored. Rock salt is being mined, both by the open-shaft method and by dissolving and flushing out salt with high-pressure hot water. Compressed air or gas is then forced down atop the fluid to force it to the surface through pipes carried to near the bottom of the cavity.

Experiments looking toward the effective sealing off of topographically suitable sands for the storage of natural gas as yet have not proved the effectiveness of such expedients, although some laboratory studies on halting migration have held out promise of satisfactory results in selected areas.

With upwards of a billion and a half dollars earmarked for pipeline expansion in 1957 on the North American continent, only short supply of pipe—especially in the larger diameters—and high cost of development funds can prevent the pipeline industry from experiencing another peak year, which undoubtedly will see even greater strides toward making pipelining a science. END



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(*Continued from page 43*)

Under present crisis conditions, there are only sufficient tankers available for about 80% of Europe's requirements of crude to be carried there. If the oil industry goes all out for the long haul, this deficiency would have to be made up before arrangements could be made for handling the annually increasing consumption. Thus it would appear that, in the latter case, it would be necessary at least to double capacity of the tanker fleet handling Middle East crude.

Doubling of the capacity of the tanker fleet is not by any means a simple operation. In the first place, it can be assumed that in future the major portion of this crude-oil carrying will be done by mammoth tankers, say 80,000 to 100,000 dwt—probably more of the larger size than the smaller. The loading locations, whether at jetties or at sea lines, must have sufficient depth of water at all states of tide to accommodate vessels of this draft. This may entail extensive alteration of some of the present loading places, and probably provision of new ones, to take care of the increasing bulk of the traffic. In addition to greater depths of water, larger-diameter loading lines will have to be provided so that a quicker intake of cargo can be made. It is little use to provide a tanker of double capacity if double loading time is involved. Increased storage capacity at the terminal could also be very desirable. Some of the present-day storage tanks have a capacity approaching 225,000 bbl (30,000 tons). Contents of over three of these would be required to charge a 100,000 dwt tanker.

A recent industry study has outlined the 1965 tanker situation to the best of the industry's ability. According to the study, ocean-going petroleum tankers reported under construction or on order in world shipyards and definitely planned by tanker owners have increased from 28.9 million dwt tons on Dec. 14, 1956, to 38 million dwt tons in March, 1957. This enormous increase amounts to 9,066,120 tons. Of this, it would appear that an increase of approximately 4,000,000 tons took place as a result of tanker construction contracts placed during a two-month period from November 1, 1956 to January 1, 1957. The balance of increase is in the category of planned construction.

The Committee on Tanker Construction, headed by B. Brewster Jennings, Socony Mobil Oil Company, Inc., estimated that in 1965 world tanker fleet, excluding government and military tankers as well as those of the U.S.S.R. and satellite counties, allowing for obsolescence, scrappage, possible conversions and adding tankers under construction or on order for which contracts have been definitely signed, the world tanker fleet should amount to approximately 4,346 T-2's. This would be an increase of 82% over the January 1, 1957 world tanker fleet or a compounded annual growth of 7.4% over the period to 1965.

The committee further estimated that about 25/50 ships now on order or under construction could be enlarged to the 60,000 tons or over capacity. However, the exact amount of additional tonnage that could be gained by enlarging individual vessels over the size now ordered or planned is a somewhat academic figure since increasing the size of each tanker would cause a delay in its completion and thus only accomplish building big ships at the expense of reducing the number delivered. Even with larger ships delivered the shipyard capacity would not be appreciably increased above the approximate annual 300 T-2 equivalents.

The committee further stated that:

1. Active world shipyard tanker capacity, allowing for slippages which are likely to occur, appears to be fully booked through 1961. This represents more tanker capacity, on order or under construction, than at any time in history.

2. If all tankers definitely planned by tanker owners are built, shipyard tanker capacity will be fully booked through 1964 and into 1965.

3. There is an indicated shortage of steel and possibility of shipyard labor in certain countries over the next several years.

4. Shipyard construction capacity should average 300 equivalent T-2's per year from now through 1965, somewhat less than 300 for the next several years, and slightly in excess of 300 over the later years.

5. Considerable work is required in development of ports and port facilities, including drydocks and repair facilities, for large tankers now being built or in the planning stage.

The report also points out a definite limitation in the number of dry docks worldwide which can accommodate tankers of 60,000 dwt and over.

This condition is of particular importance. There are only nine loading terminals in the world which can or will soon be able to handle 60,000 dwt tankers. They are Ras Tanura, Mina al Ahmadi, Sung i Pakning (Indonesia), Sidon, Banias, Tripoli, Amuay Bay (Venezuela), Puerto La Cruz (Venezuala), and Dumai (Indonesia). Not all of these can handle the big ships immediately. There are only 13 discharge terminals that can handle such large ships, and ten more ports which with future terminal construction and improvement could handle them.

Since there are few ports at present in the world which can accommodate large tankers for discharge, preparations would have to be made in the various countries for the provision of these facilities at locations suitable for delivery of crude to refineries. Suggestions have been made that central receiving ports with sufficient depth of water to accommodate any projected size of tanker, together with large storage capacity, should be established. Distribution to individual refinery harbors would then be made by smaller tankers. This would greatly increase the cost, however; therefore, wherever possible, each refining center should have its suitable oil harbor, with large storage accommodation and large-sized lines.

At most loading stations for Middle East crude oil, conditions are such that arrangements could be made, without undue expense, for the berthing and loading of the projected mammoth tankers. At Fao, the loading terminal of the Basrah Oil Co., this would be difficult; but conversations have already taken place with a view to the provision of loading facilities for Basrah crude in Kuwait via a pipeline to the new terminal. This outlet for Iraq crude at Kuwait has been discussed in the Iraq parliament. It has the advantage of the major portion of the lines' being located in Iraq territory, with the remaining portion passing through the British protectorate of Kuwait.

Generally speaking, therefore, there is no major difficulty in provision of loading facilities in the Middle East for the projected mammoth tankers of the largest size.

The provision of discharge ports in Europe is a different question. At the present time there is no port in Europe where a 100,000 dwt tanker could be berthed and discharged. There is little doubt, however, that discharge ports will be available, either in the USA or in Europe, by the time these large tankers are in commission.

In the United Kingdom it is the intention of Esso Petroleum Co. Ltd. and British Petroleum Co. Ltd. to provide such berths at Milford Haven. Work is now in progress. At Finnart, where BP has an ocean terminal delivering into the 47-mile pipeline to Grangemouth, an extension of the present jetty could be made to where very deep water is available. A considerable amount of dredging would be required to enable tankers of the projected size to be berthed on the Thames and Medway, but the task is not an impossible one. At Fawley, the channel is deep enough to accommodate a vessel of 40-ft draft.

The "Sinclair Petrolore," an oil-ore carrier of 56,089 dwt tons and carrying a cargo of 52,600 tons of Kuwait crude oil, berthed at Fawley on December 24, 1956. She has a length of 789 feet, beam of 106 ft 5 in. and a draft of just under 40 feet. For the larger vessels, the depth of the channel would have to be increased.

It would appear, however, that the 60,000 to 65,000 dwt tankers, some of which are on order by both oil companies and by independent carriers, would be the maximum-sized tanker which would be practical for the Persian Gulf-Europe service round the cape. Another point in favor of this size of vessel is that, at about this size, the cost per ton of transport of crude oil via the cape from the Persian Gulf to Europe can be reduced to about the cost per ton of crude oil brought through the canal by the largest tankers which can transit that way with a full cargo. END

[e] World Petroleum Tanker Construction—a report of The National Petroleum Council, March 7, 1957.

Based on his many years at sea, the author offers a unique system for simplification of the suction systems used in tanker loading and discharging. He proposes a simple gravity flow, with much lower installation costs and longer operating life.

SIMPLIFICATION OF TANKER SUCTION AND LOADING SYSTEMS

by Captain H. Russell

As the modern tanker grows in size, the suction system designed for cargo discharge has grown along with it. Modifications have been made as additions to the existing system. As a consequence, the discharge system has grown more complex, with a resultant increase in the possibility of trouble developing between the tank suctions and the pumps, where most of the headaches arise.

Leaky valves, leaky glands, and leaks in the pipeline are the major problems during the operation of these vessels, and are responsible for a good portion of the loss of revenue due to loss of time and expensive repairs. For the tanker operator, an ideal tanker would be one which involves no pipelines nor suctions except at the pumps.

It is time to take a fresh look at this type of vessel with a view to reconstructing the systems presently used.

The tanker itself is a compartmentalized hull with engines and boilers located in the stern. As the vessel is discharged, the bow rises more rapidly than the stern until she assumes a position as in Fig. 1. Under the circumstances, the law of gravity is working in the ship's favor during the entire period of discharge. Bearing this fact in mind, we may proceed to the reconstruction of the suction system, using for this purpose as an illustration the most common type of tanker in operation today, namely the T2.

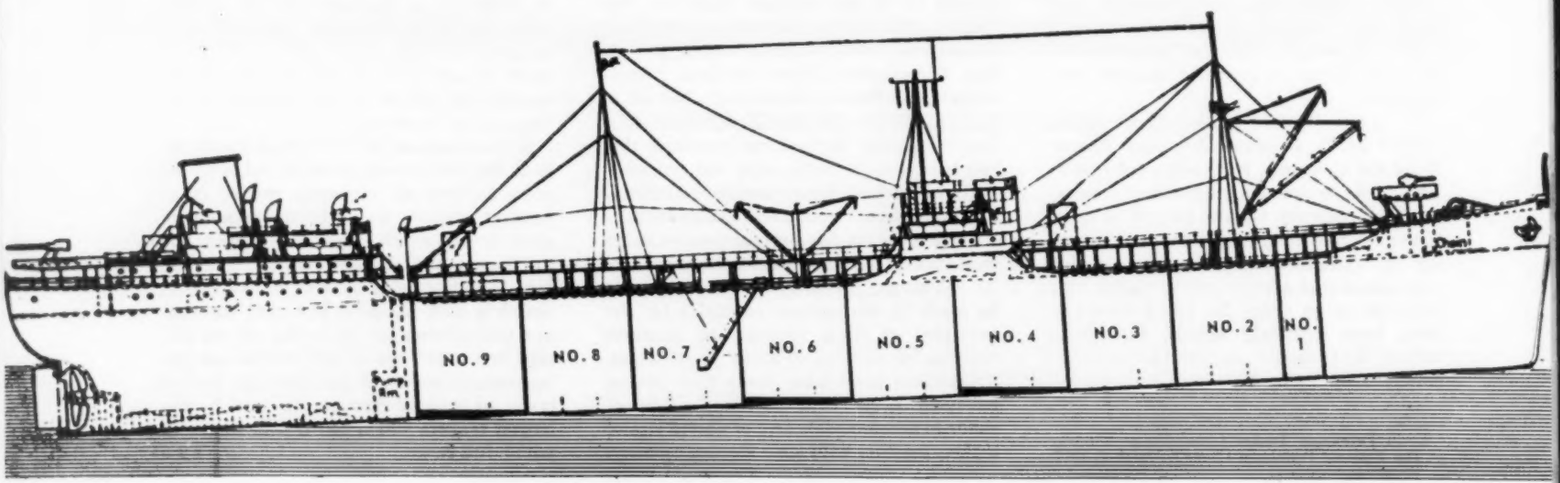
A brief description of the suction system of a T2 tanker would include a 12-in suction line, with a suction in each individual tank; a 4-in. stripping line, with a suction in each tank; master valves on the 12-in. line between individual tanks and master valves likewise on the stripping line; a number of crossover valves between the lines which are used for splitting the cargo; and master valves between the main cargo lines, the stripping lines, and the pump room. This system, as it exists on T2's at present, is illustrated in Fig. 1.

Since this system is set between 3 ft. and 4 ft. above the ship's bottom, it becomes obvious that once this level of oil is reached a leak anywhere along the line, either in the valves or the pipeline, will result in the pumping system's becoming airbound. When such a situation develops, the problem of locating and blocking out the leak becomes a major operation—with consequent expense and loss of time. Very often resort has to be had to the stripping pump to finish operations. The vessel may have to be gas-freed at sea, and a test of the entire system may be necessary.

A solution to the problem is to reduce to a minimum the quantity of pipeline and the number of valves without detracting from the flexibility of operation of the tanker itself.

No real dent can be made in this problem which afflicts tankers as a whole, however, unless we revise our fundamental approach. Perhaps it would be best to start our re-

Discharged vessel showing trim in light condition and gravity flow of liquid with No. 4, 6, and 8 tanks for stripping.



construction of the present-day suction system of tankers by stating the specific requirements for a pipeline system under operating conditions. These are:

1. It should be able to discharge its cargo down to the last few gallons with a minimum of difficulty.
2. It should permit cargo separation.
3. It should be able to load the vessel so that a proper draft can be maintained.
4. It should be able properly to ballast the vessel for sea.
5. It should be able readily to permit gas-freeing operations.

Given all of the above, it can be reasonably said we have a system which can perform all the normal functions of the systems presently in existence. By tackling the items in the above list in numerical order to find a suitable solution for each, we shall be in a position to assume that the sum total will be the ideal pipeline system for an operating vessel.

Item (1) requires us to pump a vessel down to the last drop of cargo. It says nothing about splitting cargo, so we shall assume we are working on a vessel designed to carry a single cargo. In this case we can formulate an ideal suction system requiring no pipeline and no pipeline valves. A single suction enters No. 9 center tank, and is connected in the pump room to all of the pumps. The remainder of the ship is joined to this suction by means of sluice valves of the type illustrated in Fig. 2.

This sluice valve is a gate valve without the flange on each end. The pipe on the forward end is welded to the after side of the bulkhead at its lowest point, where the oil tends to travel, and sits on the ship's bottom. A screen—heavy wire-mesh, wide-woven at the top, and a little closer at the bottom—is installed on the forward part of the bulkhead, to prevent the entry of heavy rust. The valve has no sediment bowl which permits it to sit flush on the ship's bottom, but slots cut in the after seat permit the valve gate to flush fine sediment out as the valve gate works up and down. Since the valve does not have to be air-tight, a bronze bushing is substituted in the bonnet for the packing gland ordinarily used in this type of valve.

The valve stem moves up and down through this bronze bushing when the valve gate is raised and lowered. This permits the use of a rising stem on deck which will act as an indicator at all times to show whether the valve is open or shut. This requires, of course, a straight reach rod to go right up through the deck from the valve. If desired, an internal thread valve can be used, but in that case the typical indicator stand now in use would be required.

This valve, and its location in the tank, permits the law of gravity—installed in the design of the ship by the location of the engines and boilers in the stern—to operate as part of the loading and discharging system. From this point on we shall refer to this type of valve as a sluice valve, and any other valves will be designated as suction valves when installed on the end of a suction line.

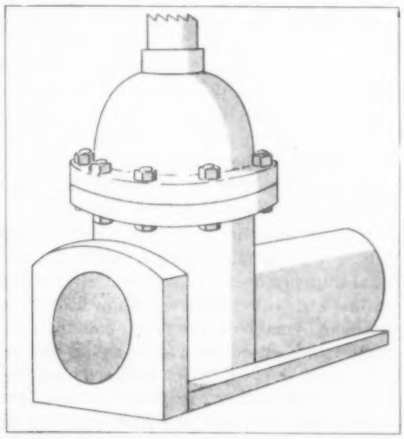
These sluice valves are welded behind the bulkheads in each tank, wings, and centers at the lowest points where the oil flows. Two of these same valves are used between the wings and centers of No. 9. As the vessel is discharged, the bow rises and gravity carries the oil back to No. 9 center through the sluice valves where it is picked up by the pumps. By the time No. 9 center is ready for stripping, the rest of the ship will be dry. To insure even pumping along the entire length of the ship, the sluice valves are made larger and have a greater opening than the suction valve in No. 9 center so as to insure that the level of all tanks will be maintained as the discharge progresses.

In the event the vessel tends to list, the situation is corrected by closing down on the sluice valve between No. 9 center and the proper wing tank.

By means of this sluice valve we have solved the problem listed under item No. 1 and done so without the use of any pipeline in the tanks.

Item (2) in our list of requirements specifies cargo separation; and, since we are using a T2 as an example, we shall split our cargo as it is done on these vessels at present. Fig. 3 is an illustration showing the pipeline required when the sluice valve shown in Fig. 2 is used. The suction line and valves for tanks No. 7, 8, and 9 are in the pump room where they will not be subject to corrosion and where the valves can always be worked on when necessary. Only the suction ends of the line are in the wings and center of No. 9. Thus the only pipelines and valves in the tanks are the lines going to tanks No. 6 and 4, with their branches extending into their respective wings.

A comparison between Fig. 5 and Fig. 3 shows the great extent to which simplification has taken place as a result of the use of a sluice valve between the bulkheads. The extent of the reduction is amplified further by the fact that the sluice valve never requires maintenance for air leaks through the packing glands, since they are not required to be air-tight; therefore, valve maintenance has been reduced to a minimum by the use of bronze bushings instead of packing material. Nor will these valves become tight and bind, since ample tolerance can be allowed between the stem and the bushing. Such simplification and reduction of maintenance warrants a close examination of this system to see if it will perform satisfactorily.



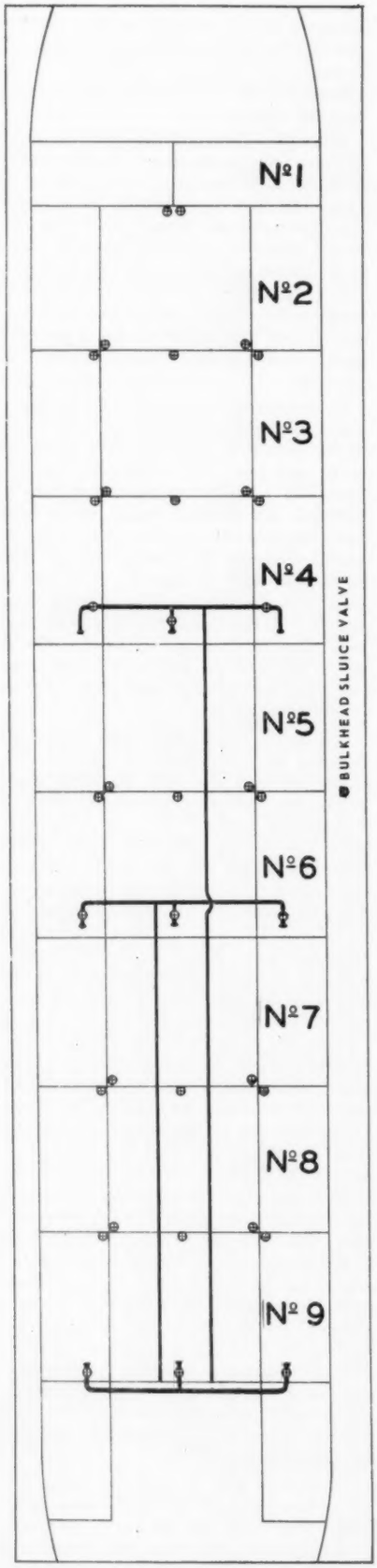
Bulkhead gravity sluice valve (an illustrative drawing, not to scale).

As can be seen from Fig. 3, three grades of cargo can be discharged simultaneously with three pumps. No contamination of cargo can take place at this point, since there are no sluice valves in the bulkheads at the points of cargo separation at bulkheads, No. 4 and 5, and at bulkheads No. 6 and 7. There are no crossover valves between these systems; therefore, contamination cannot take place in the tanks. The pump-room crossovers alone require inspection.

It is customary practice in discharging a tanker to hold back some tanks in the event of lost suction during operations when the cargo gets low. These tanks are used to prime the pumps when suction is lost. To facilitate this practice, sluice valves have been installed between the wings and centers of tanks No. 3, 5, and 8. This enables us to hold back centers No. 4, 6, and 9, since these suction valves can be kept closed and the discharge operations can take place through the wings at No. 4, 6, and 9. When all the remainder of the cargo has been discharged, then, these centers can be pumped out.

We have solved the cargo separation problem from the point of view of discharge. We can also load the wings separately, as well as the centers, likewise through the suction system as it now exists. However, we wish to give this system flexibility which can be used for further cargo separation and for the purposes required in items (3), (4), and (5) in our list. To do this, we install the deck drop system as illustrated in Fig. 4. In this illustration, only the center drops go right down to the bottom of the tanks—the wing drops being cut off at the deck. We can now load through the drops at No. 1, 3, 5, and 7, as well as through the pump room. No. 3, 5, and 7, while dropping in the centers, will also load the wings by opening the sluice valves between the wings and the centers. Now we can further split the cargo if so desired. To illustrate, we can load No 7 and 8 with one grade through the drop, and No. 9 with another grade through the pump room. The same can be done with No. 1, 2, 3, and 4, and with No. 5 and 6. The lighter grades will be loaded closer to the suctions at No. 4, 6, and 9; and, when they are discharged, the darker grades can then be worked on. This drop arrangement on deck now gives us ample flexibility for splitting cargoes as desired. In addition, by staggering the drops as say between No. 2 center and No. 3 wings, our flexibility for loading increases still further.

Cargo may also be split by using the wing and center bulkheads as division bulkheads. The wings may be loaded with different grades of cargo than the centers, and the different grades would not go through tanks which had previously held other



Modified design of suction pipeline system at bottom of tanks for T2 tanker.

grades. This also permits selection of any grade desired for discharge at any time suitable to the refinery. Thus, if grade "A" were carried in the wings and grade "B" in the centers, either cargo could be discharged in the order of priority required.

Item (3) of our list requires us to be able to trim ship so as to get proper draft. Since No. 9 center can be isolated during loading and No. 1 port and starboard have drops in them, they can be held back to the last and used to trim ship. No. 3 centers and wings, as well as No. 7 centers and wings, can also be used for this purpose if so desired. To bring the vessel down bodily, No. 6 can be used. It is evident that trimming with this system is no problem.

For ballasting as required by item No. 4, we can ballast 3, 5, and 7 tanks across. This will be done through the drops. No. 1, if required, can also be ballasted in that fashion, and No. 9 can be ballasted through the suction line into No. 9 tanks. Also the wings can be ballasted without the centers, or the centers without the wings. The S.S. "R. E. Wilson" carries ballast in the wings with empty centers down the coast continuously between New York and Texas City. A close study of this arrangement shows many ways in which adequate ballast may be carried without difficulty.

The remaining item on our list involves the problem of gas-freeing the ship. Fig. 5 illustrates the trim of the vessel in the light condition, showing the extreme drag which prevails in the draft fore and aft. A somewhat similar degree of drag prevails in the ballasted condition when gas-freeing operations are taking place. As can be seen from the illustration, all of the stripping operations take place in the cargo tanks containing the suctions at the ends of the pipelines in the tanks. This means the sluice valves from the other tanks into these suctions must be open to permit the dirty water and sludge to run to the suctions. This makes the stripping operations during gas-freeing a simple operation which requires no strenuous efforts on the part of the pumpman to observe the conditions in the tanks being cleaned, since everything runs to the suctions by gravity. The same situations prevail when cargo is being discharged. For gas-freeing, the wings can be ballasted while the centers are cleaned. When this operation is completed, the ballast is shifted and the wings are then gas-freed—completing the job. This method may be varied if desired, since the entire discharge and loading system of the vessel permits considerable variation due to the flexibility built into it by the drop lines from the deck.

Here a word may be said about testing tanks, a required operation when the annual shipyard overhaul is due. A close study of the system outlined will show this is no problem, since both the drops and the suctions can be used for ballasting as desired to stagger the ballast for bulkhead inspection. A little shifting may be required, but not enough to cause any inconvenience or loss of time.

Anyone familiar with tanker operations will readily perceive that the outlined system is based on a physical characteristic typical of the modern tanker, viz., the locaton of the engine and auxiliary machinery in the stern of the vessel. The consequent change in trim of the vessel will always favor the more rapid decrease of the forward draft when the ship is being discharged, even though she arrives at the discharge port down by the head. With such an extreme drag actually built into the ship, it seems anomalous to install suctions and pipeline in every tank and thus contribute towards the multiplication of possible trouble by multiplying the amount of equipment used, particularly when gravity will perform the work with almost trouble-free assurance. A comparison of Fig. 1 and 3 will emphasize this fact; and, since the system outlined in Fig. 3 will perform all of the functions outlined in our list of required operations, it would seem that serious consideration would call for substitution of such a system in place of those presently in use.

Of course, this outline has been based on modification of the system in use on the T2 tanker presently in use, but it also can be substituted with slight modification for systems used on other tankers already built and on those under construction. Larger vessels under construction at the present time have 10 to 12 sets of tanks, and the cargo separation may call for the carriage of many grades of cargo. But the system outlined herein can be modified still further to suit their needs without the use of superfluous valves and piping—which in the future would contribute a great deal towards an increase in possible development of expensive troubles and repairs.

The location of the sluice valves in the extreme bottom of the tank raises the question of rust, but the heavy-mesh screening on the forward side of the bulkhead at the valve location should eliminate any difficulties so far as this problem is concerned. The screening would very likely serve longer and better if made of stainless steel or monel metal, and the tendency for rust to collect around it would not be so great as it is around present-day suction bell housings, since the liquid would flow through the valve rather than be sucked towards it as is presently the case.

A word might be said about symmetry in the design of suction and loading lines for tankers. Lack of symmetry at the suctions and loading points is largely responsible for the tendency of some tankers to list when cargo is being loaded and discharged. The liquid being carried has a tendency to leave and enter more rapidly through the points closest to the suction. Such being the case, it is possible—because of the small quantity of piping used in this design—to make the system completely symmetrical at those points where it is necessary in order to get a ship which will remain on an even keel without too much valve manipulation.

It might be pointed out here that the sluice valves used between the wings and centers in the described system are by no

means absolutely necessary and may be dispensed with, although a loss in flexibility of operation would ensue. This flexibility also makes it possible to load and discharge a tank even though one of its sluice valves for some reason or other becomes inoperable, although this eventuality is much less likely if rising-stem valves are used. The usual difficulty experienced in the present-day suction valve involves the disengagement or breakage of the yoke at the valve bonnet as the result of corrosion; and, since the rising-stem valve does not require such a yoke, it hardly seems likely any problem would arise in the suggested sluice valves. The use of the rising-stem valve is problematical and requires testing, since it must be discovered whether the length of the reach rod and its weight would make such an arrangement on the deck difficult to operate. In that case, a geared wheel to the rising stem would solve that problem. In any event, the internal thread could be used, but by so doing they would lose the value of the rising stem as an indicator for the condition of the valve.

In closing, it might be pointed out the amount of piping inside the tanks is so small that in the light oil trade it could be replaced at small expense every two or three years to forestall the possible development of trouble due to corrosion. As for pipeline testing, this becomes easy, since there is so little pipeline to test.

For those who may still be skeptical about the efficacy of this system, we may set ourselves a problem of loading six grades of cargo using the outlined pipeline system. The cargo will consist of a colored housebrand gasoline, white gasoline, heating oil, kerosine, and a dark and light grade of lube oil. The gasoline can be split between No. 1, 2, 3, and 4 as follows: The housebrand being colored will go into No. 1 and 2 through the drops in No. 1. The white gas will go into No. 3 and 4 through the suctions in No. 4 tank. The heating oil will go into No. 5 through the drop, and the kerosine into No. 6 through the suction in No. 6 tank. The dark lube oil will go into No. 7 and 8 through the drop, and the light lube oil into No. 9 through the suctions in No. 9. When discharging, the light colored cargo will be discharged first through the suctions, which will avoid the danger of discoloration. When these are discharged, the balance of the cargo is then removed by opening the sluice valves and permitting them to gravitate to their respective suctions. This can be increased to 7 grades if so desired, since the drop into No. 3 has not been used in our example. Furthermore, additional grades can be carried in some of the wings which have drops. We are justified in saying that this system will carry 10 grades with ease and, with a little bit of extra work, can be increased to 12 or 13. The quantities of each grade may be varied by the manner in which the drops and suctions are used to fill tanks No. 2, 3, and 8 and, by staggering the drops as previously suggested, additional loading flexibility can be built into the system, as shown.

A typical example of gas-freeing would be as follows: Ballast would be pumped into wings No. 3, 5, 7, and 9; and, if this were insufficient, No. 4 and 8 could also be loaded. We then start forward and open the sluice valves in the centers. While No. 1 and 2 are being washed, the sludge flows back to No. 4 center by gravity, where the stripping pump is carrying it over the side. With No. 1 and 2 completed, we close the sluice valves, open the tank tops, and proceed to wash No. 3 and 4. In this manner we proceed with the rest of the center tanks. When they are done, we transfer ballast by filling centers No. 3, 5, 7, and 9 and pumping out the wings. With the ballast shifted, we proceed to wash the wings in the same manner as the center were done. It will be noted that in the process of washing tanks, only three sets of valves are used for stripping the suction valves in tanks No. 4, 6, and 9; whereas in present arrangements all the stripping valves on the ship have to be handled and watched. This justifies the observation that the modified system reduces stripping operations by two-thirds those now required.

In view of the foregoing, it is possible to claim for the modified system herein described the following:

It can discharge its cargo down to the last few gallons better than the present system, since it reduces stripping down to three sets of tanks.

It permits the carriage of 7 to 12 grades of cargo without contaminations; and, with slight variation, can increase still further the cargo separation permitted.

It permits loading to proper and required draft for sea.

It can ballast the ship properly for sea.

It permits easy gas-freeing operations when required.

It will strip cargo with greater ease than present systems.

It eliminates the development of possible trouble in the discharge system by eliminating the greater part of the suction lines presently in use and the greater part of the pipeline valves presently in use where these troubles originate.

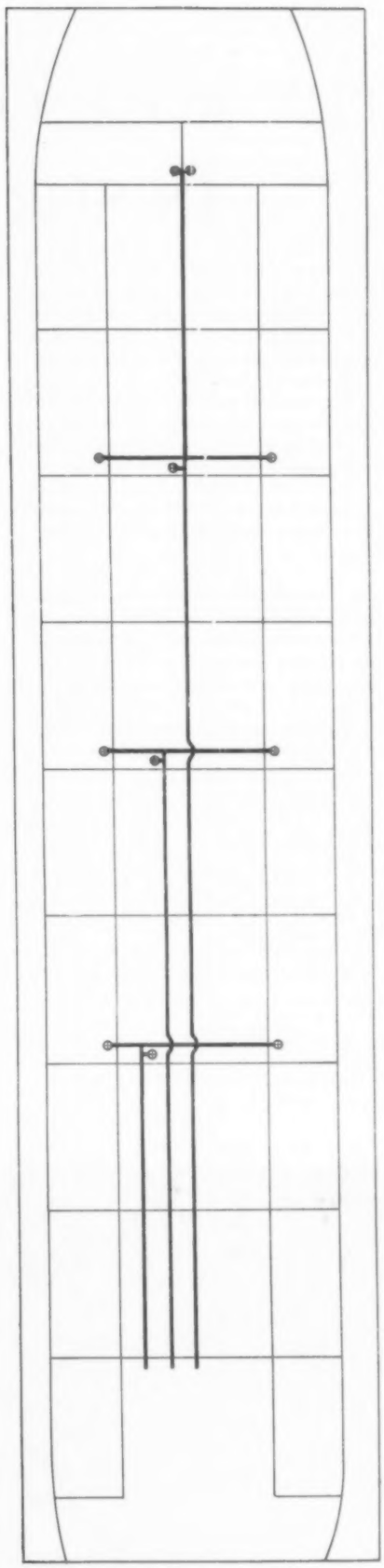
The use of the rising stem permits visual observation of the valve conditions during operations much more readily than present systems.

By reducing the pipeline to a bare minimum, it permits a reasonably cheap periodic replacement of the entire pipeline system if so desired.

Since opening the sluice valves does not affect the suctions when discharging, once the valves are set the vessel will automatically discharge herself down to the stripping level.

Reduction of the number of suction valves reduces by two-thirds the amount of nuts, bolts, and rust which will collect in the strainer boxes at the pump.

In view of the above advantages, the outlined system warrants a careful study, particularly by those plagued with pipeline troubles in the tanker industry. END



Deck plan of cargo line showing droplines into tanks. Manifold arrangement not shown.

Part II

THE ROLE OF PETROCHEMICALS IN SURFACE COATINGS

*by Peter W. Sherwood**

In Part I of this series,† we listed 21 petroleum-derived chemical compounds which play a prominent role in formulation of paints and lacquers. Some of these are principally dependent on the surface-coatings industry for their sales; for others, surface coatings constitute but a minor market.

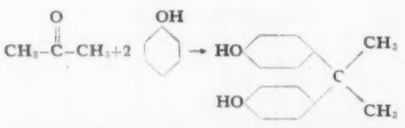
Accordingly, our list of 21 commodities may be classified by the relative importance of the surface-coatings industry as a percentage of total sales. Such an arrangement will comprise the following three major groups:

Group I	*Group II*	*Group III*
Compounds Which Are Primarily Dependent on Surface-Coatings Market	Compounds Which Depend Significantly, but not Preponderantly on the Surface-Coatings Market	Compounds for which Surface Coatings are Only a Minor Share of the Market
Bisphenol-A	Acetone	Acetaldehyde
Epichlorohydrin	n-butanol	Ethyl alcohol
Glycerine	Formaldehyde	Isopropyl alcohol
Ketones, other than acetone	Napththenic acids	Phenol
Maleic anhydride	Vinyl acetate	Styrene
Pentaerythritol	Xylenes (excluding fuel use)	Toluene
Phthalic anhydride		Urea
		Vinyl chloride

A look at group I shows that there are seven important chemical commodities which are primarily tied to the economics and sales of the surface-coatings industry—their primary market. The remaining discussion will be concentrated primarily on the status of the chemicals in this category, and on their position in the pattern of the petrochemicals industry.

1. *Bisphenol-A:* This compound is not, today, produced on a very large scale. However, it has important growth potential due to the fast-growing popularity of epoxy resins in surface coatings. Typically, these resins are obtained by the co-polymerization of four moles bisphenol-A with one mole epichlorohydrin.

Bisphenol-A (4,4'-isopropylidenediphenol) is produced by the condensation of two moles phenol with one mole acetone.



Strong acids, particularly sulfuric or hydrochloric, serve as catalyst for this reaction. Reaction temperature is held between 15 C and 60 C. Molar ratio of phenol: acetone in the feed is about 3.5 i.e., about 75% higher than stoichiometric requirements. Anhydrous HC1 is used at 0.1 to 0.5 moles per mole acetone.

A highly favorable effect on reaction time has been reported for the addition of certain mercapto acids as promoter for the condensing agent. By use of this accelerator plus hydrogen chloride, satisfactory yield of 75% to 90% (on acetone) has been reported after 2 hours, in the absence of solvent.

The reaction product is dissolved in benzene. The solution is freed of mineral acids by careful neutralization and water washing. Bisphenol-A is finally recovered in purified form by vacuum distillation.

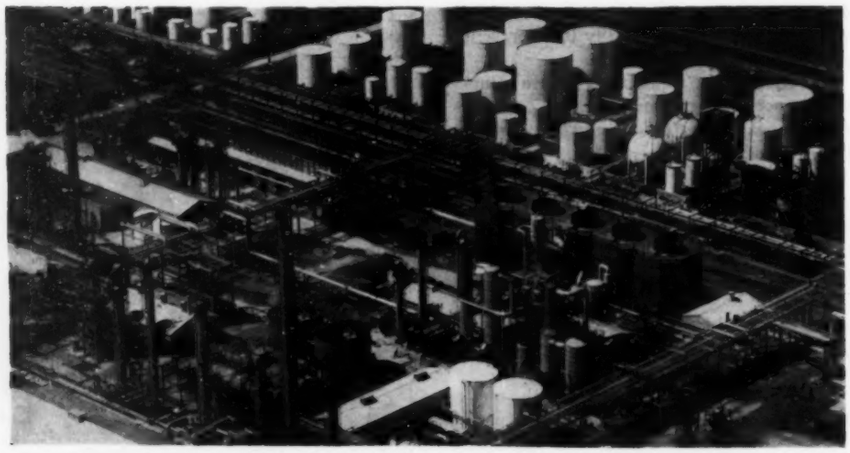
Both of the two raw materials for bisphenol-A in recent years have experienced a major shift in technology. The biggest impact on both has been made by the advent of the cumene autoxidation process which yields phenol and acetone simultaneously. First commercialized in the latter part of 1953, this process yielded, in 1955, 13.5% of the total phenol output, and its share continues on the uptrend.

Classical routes to phenol, starting with benzene as raw material, accounted for 78.5% of the total output of 516.7 million pounds in 1955. The remainder is so-called "natural" phenol obtained directly from petroleum and from coal tars. To phenol, however, the surface-coatings industry is only a minor factor; in all, it accounts for some 4% to 5% of total sales.

Acetone, the second intermediate for bisphenol-A, is today in oversupply. Output in 1955 was 539 million pounds. It is today available by the classical route from propylene via isopropanol, and also as a by-product of three newer processes. First, there is the partial oxidation of butane-propane, carried out by Celanese Corp. of America and by Warren Petroleum Corp. This yields acetone together with other oxygenated products, notably aliphatic aldehydes and alcohols.

Second, there is the autoxidation of cumene, referred to above. This is geared primarily to the production of phenol, but yields about 0.55 lb. acetone with each pound phenol produced. Finally, there is a wholly new source: the partial oxidation of isopropanol to hydrogen peroxide and acetone. A version of this process is about to be taken onstream at Shell Chemical Co.'s Norco, La. plant.

2. *Epichlorohydrin:* Like bisphenol-A, this chemical is just on the uptrend toward an important position in the surface-coatings industry. Its promise, too, is also entirely due to the growing importance of epoxy resins which are expected to move into the second-most important position within the next year or so. According to one forecast, the epoxy resins will constitute one-half the dollar volume of the giant alkyd resins by 1960.



Shell Chemical Co. synthetic glycerine plant at Deer Park, Texas (courtesy Shell Chemical).

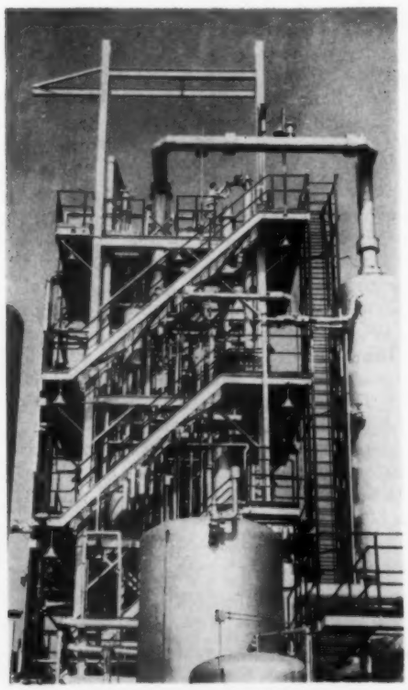
*Chemical engineer, White Plains, N. Y.
†World Petroleum, February 1957, p. 54.

No actual production figures for epichlorohydrin are available—the product is manufactured today only by Shell Chemical Co., and Dow will probably become another manufacturer. This is a logical development in line with the position of these two companies as producers of synthetic glycerin by the allyl-chloride route, which is closely linked to ipichlorohydrin manufacture. Two other chemical companies—Carbide & Carbon Chemicals Corp. and Olin-Mathieson—have shown definite signs of interest in this field.

The method and economics of epichlorohydrin production are tied intimately to the synthesis of glycerin by the allyl-chloride route, and will be discussed hereinafter within this framework.

3. *Glycerin:* Of all glycerin produced (approximately 235 million pounds in 1956), some 30% is converted to alkyd resins and ester gums, almost exclusively for the production of paints and lacquers. Another 10% to 12% is consumed in the production of drying oils, etc. Thus, the surface coatings industry clearly constitute the controlling market for glycerin (explosives and tobacco manufacture, the second-largest consumers, each account for only 12% of glycerin consumption).

Prior to 1948, all glycerin was obtained from natural sources as byproduct in the manufacture of soap and fatty acids. Since then, the glycerin industry has undergone a fundamental change. Today synthetic glycerin, derived from propylene, provides between one-third and one-half of requirements (the closest guess is 110 million pounds synthetic glycerin out of a total output of 235 million pounds in 1956).



An overall view of the maleic anhydride manufacturing facilities of Reichhold Chemicals Inc., Elizabeth, N. J. (courtesy Reichhold Chemicals).

The change came in 1948 when Shell Chemical Co. began operation of the first synthetic glycerin plant at its Deer Park, Texas, installation. Since then, this company has added two new facilities at Norco, La. (one to produce intermediate allyl chloride for the Deer Park process, the other to produce glycerin by a wholly new route via acrolein). In 1955, Dow Chemical Co. entered the ranks of synthetic glycerin producers, with a 36-million-pound-year facility at Freeport, Texas, using the allyl-chloride route. (There have since been rumors that Dow expects to expand its unit to as much as twice its original capacity).

An entirely new process for the synthesis of glycerin has now been pioneered by Shell Chemical Co., at Norco, La. Here, propylene is converted to acrolein, which is then reacted with an alcohol (ethanol or isopropanol) to yield allyl alcohol. As final step, allyl alcohol is reacted with hydrogen peroxide to form glycerin. The process represents several novel departures. New processes are used for the synthesis of intermediates acrolein, allyl alcohol, and hydrogen peroxide—the latter being obtained by partial oxidation of isopropyl alcohol. Finally, the last step, viz., reaction of allyl alcohol with hydrogen peroxide to yield glycerin, is a major new contribution to chemical technology.

The new method of glycerin synthesis frees large amounts of allyl chloride from the conventional glycerin process for epichlorohydrin synthesis.

In the conventional glycerin synthesis, allyl chloride is obtained by high-temperature (500 C to 530 C) chlorination of propylene. The product is treated with hypochlorous acid (i.e., chlorine in water) to yield glycerin dichlorohydrin.

This intermediate finally may be hydrolized by aqueous caustic soda to yield glycerin. But an alternate, and probably more economical, version effects the hydrolysis in two stages. In the first of these, glycerin dichlorohydrin is treated with aqueous lime slurry to form epichlorohydrin.

The importance of this chemical to the surface-coatings industry has been discussed hereinbefore. But, in the synthesis of glycerin, it serves as intermediate; and the conversion from epichlorohydrin to glycerin is carried out by a final hydrolysis with aqueous caustic.

4. *Ketones:* Acetone is the giant among ketones. It serves the surface-coatings industry in a dual function—as solvent and as chemical intermediate; but it finds its principal markets in other industries. Some of its salient statistics are reported in our discussion of bisphenol-A.

Methyl ethyl ketone is used principally as solvent; 65% to 75% of total output finds its way into the surface-coatings industry, primarily for nitrocellulose and vinyl lacquers. Official production figures are not available (there are only two manufacturers —Shell Chemical and Esso Standard Oil), but USA output may be reasonably estimated at 170 million to 175 million pounds per year.

The material constitutes some 90% of the market for sec-butanol, itself derived wholly by the hydration of butene-1.

Methyl isobutyl ketone also finds its preponderant outlet as solvent in lacquer formulations. Production of this ketone is estimated in the range of 120 million pounds per year. An important secondary use of MIK is conversion to derivatives (methyl isobutyl carbinol, methyl isobutyl acetate) which, in their own right, are solvents of value in surface-coatings manufacture.

Methyl isobutyl ketone is synthesized from petrochemical acetone via *mesityl oxide*, itself a solvent for nitrocellulose and vinyl lacquers.

Yet another medium-boiling solvent ketone, used for cellulose acetate and nitrocellulose lacquers, among others, is diacetone alcohol. It is the most important single derivative of acetone, but its importance rests to only a limited extent on its direct use as solvent. More significantly, it serves as intermediate in the production of mesityl oxide and, via this intermediate, of methyl isobutyl ketone and carbinol—all of which are discussed hereinbefore.

5. *Maleic Anhydride:* In the single year 1955, production capacity for this dibasic acid was raised from 27 million to 50 million pounds per year to keep pace with the sudden upsurge in demand. This striking development—following many years of nearly stagnant market—has been impelled by several market developments.

Most important is the significant expansion in the output of maleic-based alkyd resins for surface-coating purposes. In this field, phthalic anhydride continues to be the reigning dibasic acid; but manufacturers have drawn on more expensive maleic, partly because the product exhibits certain special desirable properties (notably high impact resistance), and partly because there has been recurring shortage in the supply of phthalic anhydride.

Beyond that, the makers of surface coatings find uses for maleic anhydride in the production of improved drying oils. Maleic is also an intermediate in the synthesis of various plasticizers and dispersion agents for paints and lacquers.

These applications account for 60% of total maleic-anhydride consumption. The remaining 40% is shared by the production of polyester-type plastics (17% in 1955); agricultural chemicals (12%); paper sizing, pharmaceuticals, wetting agents, adhesives, etc.

A little less than 10% of maleic anhydride is obtained as byproduct in the manufacture of phthalic anhydride. The remainder is obtained directly by the partial oxidation of benzene. Until 1949, this parent hydrocarbon was obtained exclusively from coal. As the need for benzene outran the ability of the coking industries to supply, so-called "synthetic" benzene was made available from processed petroleum fractions (notably from light reformate). In 1955, 34.5% of USA benzene production was obtained from petroleum sources.

To be sure, maleic anhydride is only a

small item in the benzene picture. It is the seventh largest consumer, and accounts for only 2.8% of the benzene market. But to the maleic anhydride producer, as for other consumers of benzene, the availability of his raw material from petroleum sources has brought relief from shortages which plagued the industry repeatedly throughout the 1940's.

The conversion of benzene to maleic anhydride is carried out by air oxidation in the presence of catalysts, based mainly on vanadium pentoxide on an alumina carrier. Fixed-bed catalysis is employed universally, at this writing.

In a typical plant, air and benzene are preheated separately and the vapors are joined, in carefully controlled ratio (26 lb to 50 lb per pound of hydrocarbon) at the converter entrance. Within the reactor, the temperature is controlled at 400 C to 500 C, using fused salts as cooling medium to remove the exothermic heat of reaction.

The product is cooled and scrubbed. In most existing plants, water serves as scrubbing medium. Since this leads to maleic-acid formation, the product must be dehydrated to maleic anhydride in a subsequent step. To avoid this extra processing, as well as to side-step the serious corrosion problem which is associated with aqueous maleic acid, a recent method calls for scrubbing the reactor gases by dibutyl phthalate. Absorbed maleic anhydride is then recovered by distillation. The method has found some commercial application.

6. *Pentaerythritol:* A condensation product of formaldehyde and aectaldehyde, pentaerythritol is almost completely tied to the surface-coating industry, which consumes some 94% of peacetime output (during World War II, an important share of pentaerythritol output went into the explosive, pentaerythritol tetranitrate, which accounts today for only 1% of the market).

Pentaerythritol production has enjoyed a lusty growth. Output in 1950 was 36.4 million pounds, and 1955 volume is reported at 65 million pounds. A recent study forecasts 1960 production between 90 million and 95 million pounds—undoubtedly a conservative prediction.

Manufacturing capacity is already well ahead of demand, but expansion continues. In mid-1956, USA production facilities for pentaerythritol were rated at 73.5 million pounds per year. It is estimated that combined plant capacity by the end of 1957 will total nearly 120 million pounds per year.

Most of the increased demand is tied to the growing acceptance of pentaerythritol in the production of alkyd resins with high durability and short drying time. Similarly, this polyol finds favor in the formulation of drying oils which are characterized by excellent gloss, hardness, flexibility, durability, and by short drying time. A further advantage over competitive glycerin has been price stability, as we have mentioned in our discussion of resins. However, this advantage is now voided by the price stabilizing influence of synthetic glycerin. On an equivalent basis, the price of pentaerythritol and glycerin is approximately the same.

Synthesis of pentaerythritol calls for reaction of four molecules formaldehyde with one molecule acetaldehyde. The reaction is carried out in aqueous phase and in the presence of lime, which acts as condensing agent. Reaction temperature is 40 C to 50 C. Batch time is, typically, 1½ hours.

The product is neutralized with sulfuric acid. Precipitated calcium sulfate is separated by filtration or centrifugation. The filtrate is concentrated by vacuum evaporation, and pentaerythritol is separated by crystallization and filtration. Various intermediate purification steps are involved; and these, together with process considerations, have been reported by the author elsewhere.[4]

Both of pentaerythritol's raw materials, formaldehyde and acetaldehyde, are derived primarily from petroleum hydrocarbons. Formaldehyde is manufactured at 30 installations in the USA. At 28 of these, methanol (of which 90% is today derived from natural gas) serves as raw material. At the two other plants (owned by Celanese Corp. and by Warren Petroleum Corp., respectively), formaldehyde is obtained together with other oxygenated chemicals by the partial oxidation of propane-butane. Production in 1955 of formaldehyde was 1.26 billion pounds (37% by weight basis), nearly 25% above the previous year's volume. Of this, an estimated 14% was used for pentaerythritol synthesis.

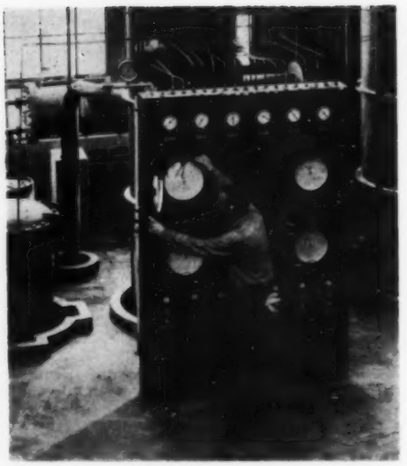
Acetaldehyde, the other raw material, is derived, above all, from ethanol. There is some production by the hydration of acetylene (a small percentage of output in the Western Hemisphere, but an important portion of Europe's acetaldehyde volume). The remainder is obtained, together with other oxygenated organics, by partial oxidation of butane-propane.

USA output of acetaldehyde was an estimated 720 million pounds in 1955. Of this, only 25 million pounds was converted to pentaerythritol.

7. *Phthalic Anhydride* is the petrochemical keystone of the modern surface coatings industries. Alkyd resins based on this dibasic acid make up 50% by weight of the 800 million pounds of resins used in paints and lacquers. Phthalic esters serve as plasticizers. Modified phthalic-alkyd formulations are used for drying-oil improvement. Phthalic acid is an intermediate in the synthesis of the dyes which make up the field of organic pigments. Market distribution shows the following pattern for phthalic anhydride:

End Use	*% of Domestic Market*
Alkyd resins, modified and unmodified	52.6
Phthalate esters	36.8
Styrene, alkyd, and polyester resins	4.6
Dyes	2.4
Other uses	3.6

Impelled by the growing acceptance of alkyd resins, phthalic-anhydride output has



Evaporators for concentration of aqueous pentaerythitrol liquors (courtesy Heyden Chemical Co.).

shown formidable expansion in the past decade. Production has grown from 137 million pounds in 1947 to 226 million pounds in 1953; 254 million in 1954; and 331 million pounds in 1955.

This growth has strained the supply of the traditional raw material, naphthalene, beyond the breaking point and, at several periods, phthalic ran severely short of demand. Nor was there the possibility of raising naphthalene supply sufficiently to meet requirements. Production of this hydrocarbon is tied to coal coking operations and, thus, to the growth of the much more slowly expanding steel industry.

The bottleneck has now been broken by the development of processes for economic production of phthalic anhydride from petroleum-derived o-xylene. The pioneer in this field has been Oronite Chemicals Co. Plans of entering this field also have been announced recently by Standard Oil Co. of Indiana.

Phthalic is produced by the air oxidation of naphthalene or o-xylene in the presence of supported vanadium-pentoxide catalyst at 350 C to 450 C. The reaction is highly exothermic, and adequate cooling must be provided (both tubular fixed-bed and fluidized-bed reactors are in service). Air-hydrocarbon ratio must be high to keep the mixture below explosive limit. In case of xylene, the (volumetric) ratio is as high as 160.

The reactor gases are cooled in several stages, permitting solid phthalic to settle out. The crude product is melted and dehydrated, and finally vacuum-distilled.

More recently, a liquid-phase process for oxidation of o-xylene to phthalic anhydride has come to the fore. This process will be the basis for the 60-million-pound-per-year phthalic plant which is about to be built by Standard Oil Co. of Indiana. END

BIBLIOGRAPHY

[1] *Burrell, H.*, Chemical Week, *March 17, 1956, p. 70 ff.*
[2] *Sayre, J. E.*, Chemical and Engineering News, *August 6, 1956, p. 3746 ff.*
[3] *Anon.*, Chemical Week, *December 18, 1954, p. 105 ff.*
[4] *Sherwood, P. W.*, Petroleum Refiner, *November 1956, p. 171 ff.*

review of PETROCHEMICAL PATENTS

Some Important Chemicals from Aromatic Hydrocarbons

by Heinz Heinemann and Harold Shalit

THE last petrochemical patent review was devoted to aromatic hydrocarbons, their preparation, and some of their reactions. The present article deals with some derivatives of aromatic hydrocarbons which can be made directly from the hydrocarbons and which have attained great importance in the petrochemical industry. The three topics discussed here are:

1. Phthalic acids
2. Aromatic hydroperoxides
3. Hexachloro-benzenes

The importance of these three classes is shown by the large number of patents devoted to them. In this article fifty-nine patents are discussed and these are not all that have been issued on these topics in the last two years. A selection has been made on the basis of general interest and importance to the petrochemical industry.

Phthalic Acids

Phthalic acid patents are reviewed under four headings: preparation by oxidation of xylenes, preparation by other methods, separation and purification, preparation of useful derivatives.

In 2,722,546 (W. G. Toland, Jr. to California Research Corp.) the xylene oxidation is carried out by heating the compound with a water soluble sulfate, a water soluble inorganic sulfur compound containing sulfur with a valence below six, and water. The reaction takes place at 400°-700°F and at pressures necessary to maintain some of the water in the liquid phase. In 2,722,547 (also to Toland) there are suggested for this reaction the specific mole ratios of sulfate to xylene in excess of 1:1 and of xylene to sulfur of at least 2:1. Toland (in 2,722,549) further suggests the oxidation of xylenes to phthalic acids by contacting the hydrocarbons with ammonium sulfate, ammonium polysulfide, and water at 550°-650°F. The mole ratio of sulfate to xylene should be from 1.55:1 to 1.75:1; while the mole ratio of polysulfide to xylene is from 0.05:1 to 0.3:1. H. J. Aroyan and J. B. Wilkes (2,734,079 to California Research Corp.) propose to decolorize the product from this ammonium sulfate oxidation by digesting the product at temperatures below the reaction temperature, in the range of 450°-630°F, and under at least equilibrium steam pressures for about two minutes. In the ammonium sulfate oxidation the primary products are the ammonium salts and amides of phthalic acids; to obtain the free acids these compounds must be hydrolyzed. According to 2,734,080, H. J. Aroyan and J. B. Wilkes (California Research Corp.) carry out this hydrolysis by acidifying the aqueous reaction product with H_2SO_4 to a pH from 2.5-3.5. This is then heated to 300°-500°F in the liquid phase, cooled to below 250°F, again acidified to pH of 2.5-3.5, and the precipitated acids filtered.

H. J. Aroyan in 2,722,548 (to California Research Corp.) proposes an improvement in the Willgerodt oxidation of xylene with water, sulfur, and ammonia, comprising charging 25-100 moles of water per mole of xylene. It is claimed that this procedure increases the speed of the reaction.

In 2,723,994 W. R. Haefele, G. W. Hearne, and S. A. Ballard (to Shell Development Co.) oxidize a liquid mixture of xylene and toluic acid with an oxygen-containing gas at 100°-275°C in the presence of a catalyst. They maintain the weight ratio of toluic acid to xylene below 75:25 but above 50:50. J. P. Fortuin and G. E. Rumscheidt (2,746,990 to Shell Development Co.) oxidize p-di-isopropyl benzene in the liquid phase with an oxygen-containing gas. Their reaction mixture comprises p-di-isopropylbenzene, a lower saturated aliphatic monocarboxylic acid, and an oxidation catalyst, which is itself a mixture of cobalt-carboxylate, manganese carboxylate, and barium carboxylate. The temperature is maintained between 60°-300°C; the di-isopropyl benzene to acid weight ratio is between 10:1 and 1:15, while the catalyst concentration is between 0.01-5% (based on the aromatic hydrocarbon).

Xylenes are oxidized with nitric acid by F. B. Zienty and M. C. Freerks (2,766,280 to Monsanto Chemical Co.). The nitric acid is slowly added to the xylene while maintaining the temperature from 120°C to the boiling point of the xylene and simultaneously removing water. The toluic acid thus formed is oxidized to phthalic acid by adding further nitric acid at temperatures above 140°C while removing water. In 2,766,281, the same authors propose to carry out the same reaction in an inert organic medium which is liquid at reaction temperature.

Some other methods for phthalic acid production have been patented. In 2,729,673 (W. W. Prichard to E. I. du Pont de Nemours) the carboxylation of aromatic hydrocarbons is carried out under anhydrous conditions by reacting the hydrocarbon with carbon monoxide at 325°-450°C in the presence of an alkanoic acid containing 2 or 3 carbon atoms and in the presence of catalytic amounts of nickel carbonyl. A. C. McKinnis (2,729,674 to Union Oil Co.) claims the preparation of isophthalic acid by decarboxylation of trimellitic acid at 150°-400°C in the presence of water and alkali. In 2,734,914 the same author applies this procedure to the preparation of terephthalic and isophthalic acids.

R. Lotz (2,740,811 to Vereinigte Glanzstoff-Fabriken A.G.) prepares terephthalic acid by treating p-xylene dichloride with 30-65% nitric acid at a temperature slightly above the melting point of the dichloride.

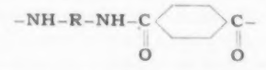
A number of patents are devoted to the separation of isophthalic and terephthalic acids or their derivatives. E. F. Carlston and F. G. Lum of the California Research Corp. (2,732,399) separate the two acids by converting them to their alkali metal salts and contacting the salts with a concentrated, aqueous solution of a water miscible alcohol. The volume of the solution is insufficient to dissolve all of the salts; the isophthalic salt is thereby concentrated in the alcohol solution. In 2,733,266, A.C. McKinnis (Union Oil Co.) uses the faster rate of esterification of isophthalic acid to separate it from terephthalic. The esterification is carried out with a lower alcohol using 0.1-10% of an acid catalyst, and for a time sufficient to react all of the iso-but only a minor amount of the terephthalic acid. The mixture is

fractionated to recover the terephthalic acid. The esters may be fractionally hydrolyzed, the mixed acids thus formed being recycled to esterification. A. C. McKinnis and J. L. Bills (2,741,633 to Union Oil Co.) separate the mixture by extracting at 50°-150°C with a solvent comprising 65-95% of an aliphatic, water soluble alcohol or glycol and 5-35% water. The alcohol or glycol should contain 1-3 carbon atoms. Substantially pure terephthalic acid remains as a residue while the extract is rich in isophthalic acid. A different approach is taken by F. G. Lum and E. F. Carlston in 2,742,496 to California Research Corp. These inventors separate the hexamethylenediamine salts of the two acids by contacting the mixture with an amount of water insufficient to dissolve all of the salts. The liquid phase is enriched in the isophthalate, the solid in terephthalate. In 2,760,974 (A. C. McKinnis to Union Oil Co.) the crude mixture is converted to the phosphoryl amide adducts by reaction with a hexa-lower alkyl substituted phosphoryl amide. The adducts are then subjected to phase separation at a temperature below the freezing point of the solid terephthalic acid adduct and above that of the isophthalic acid adduct. The separated adducts may be composed by treatment with alcohol or water.

Many patents describe poly condensations of phthalic acids; following are those considered of most general interest. E. Heisenberg and A. Watzl (2,742,451 to Vereinigte Glanzstoff-Fabriken A.G.) polymerize diglycol terephthalates by using a current of gaseous paraffin hydrocarbon, to carry out glycol at 170°-250°C. In 2,742,452 (E. Husenberg, E. Siggel, and A. Watzl of Vereinigte Glanzstoff-Fabriken, A.G.) propose that the condensation mentioned above be carried out by dispersion of the phthalic esters in a paraffin hydrocarbon having a melting point above 300°C, at the same time passing inert hydrocarbon vapors through the dispersion. M. D. Snyder (2,744,087 to E. I. du Pont de Nemours) describes the production of a dyeable polyester from terephthalic acid and ethylene glycol by incorporating up to 10 wt.% of a glycol having the formula

$$HO-(CH_2)_2-(O-CH_2CH_2)n-O(CH_2)_2-OH$$

where n is between 1-35. In 2,752,328, E. E. Magat (du Pont) claims a linear terephthalamide polymer of the structure



where R=C_6—C_8 and contains 1 or 2 methyl groups in positions 2 to 5. In another duPont patent (2,758,105 by F. P. Alles, W. R. Sauer) the molecular weight of polyalkylene terephthalates is controlled by addition of alkyl B-naphthoates and 2-carboalkoxy-3-hydroxy naphthalenes.

In 2,742,494 (R. G. Muaz to Hercules Powder Co.) there are claimed monomeric mixed esters of iso- and terephthalic acid where one carboxyl group has an alkanol of 1-4 carbons and the other is esterified with a glycol of the series HO(CH_2)nOH where n=2-10. The glycol esterification is carried out last, and preferably at 105°-125°C to minimize alcoholysis.

Aromatic Hydroperoxides

Very recently an important new reaction has been commercialized, the acid catalyzed decomposition of aromatic hydroperoxides to phenols and ketones. The hydroperoxides can be made directly from alkylated aromatic hydrocarbons by oxidation. This section is concerned with patents dealing with aromatic hydroperoxides, their preparation and decomposition.

In 2,632,774 (J. C. Conner, Jr. and A. D. Lohr to Hercules Powder Co.) aromatic hydrocarbons are oxidized in the liquid phase to hydroperoxides. The reaction is carried out with a catalyst comprising an alkali or alkaline earth metal oxide, hydroxide, or mixtures thereof at temperatures from 90-145°C and for times varying from a minimum of 0.1 hr up to that given by the expression 1nA=11.6720.0774t, where A= time in hours, t=temperature in °C. M. M. Mosnier and A. Fournet (2,697,121 to Soc. des Usines Chimique Rhone Poulenc) make cumene hydroperoxide by heating cumene with molecular oxygen in the presence of 0.08-1.0g of benzoic acid per kolgram of cumene. An improvement in the oxidation of secondary alkyl aromatics is proposed in 2,734,086 by J. M. Goppel and S. H. Zonneveld of Shell Development Co. The hydrocarbon is contacted with an oxygen containing gas in the presence of a secondary or tertiary amine, e.g. pyridine. J. P. Fortiun and H. I. Waterman (2,749,368 to Shell Development Co.) claim to decrease the induction period and inhibit side reactions by carrying the oxidation of secondary alkyl aromatics in the presence of metallic copper. Similarly H. I. Enos, Jr. of Hercules Powder Co. (2,751,418) prepares hydroperoxides from secondary alkyl aromatics by oxidizing in the liquid phase and in the presence of a finely divided metal of Group VIII having an atomic number of 44-78. The catalyst should be present at concentrations of from 1-100 times the amount which increases the rate of hydroperoxide formation by 10%. In 2,771,491 (J. C. Conner, Jr. to Hercules Powder Co.) β-isopropyl naphthalene is converted selectively to the hydroperoxide over the α-isomer. The mixture, containing 75-90% α-isomer is contacted with oxygen until hydroperoxide content is obtained corresponding to the formula X=4/3 (Y-75) + 10, where X=% conversion and Y=% β-isomer in the mixture.

The following patents deal with various aspects of the acidic decomposition of hydroperoxides to phenols and ketones. In 2,737,480 (R. T. Adams, J. C. Butler, C. D. Heaton to California Research Corp.) acetone and phenol are recovered from the neutralized product of cumene hydroperoxide decomposition by mixing the product with 0.25-3 times its weight of water. The two phases are allowed to separate, and the organic phase is distilled. L. J. Filar (2,744,143 to Hercules Powder Co.) proposes to neutralize the reaction mixture containing phenol, acetone, and H_2SO_4 by the addition of sodium phenylate in 10-60% aqueous solution. Processing difficulties are minimized and the neutralization is speeded. In 2,748,165 (H. Kroeper, G. Hummel to Badische Anilin-und Soda-Fabrik, Akt.) cumene hydroperoxide is reacted with an aqueous acidic solution containing 1-2 moles of an hydroxylamine salt or hydroxylamine sulfonic acid. The products are phenol and the oxime of acetone. M. M. Mosnier (2,761,877 to Societe des Usine Chimique Rhone Poulenc) makes phenol and acetone by introducing cumene hydroperoxide and H_2SO_4 simultaneously but separately at elevated temperatures into a medium consisting essentially of the phenol to be formed. The sulfuric acid requirements are thereby reduced.

According to 2,743,300 (G. G. Joris and W. D. Griffin to Allied Chemical and Dye Corp.) cumene hydroperoxide is converted to dimethylphenyl carbinol by reaction with cumene in the presence of at least 0.05 wt.% lead dioxide and at a temperature sufficient to decompose the cumene hydroperoxide.

L. D. Goodhue (2,768,926 to Phillips Petroleum Co.) claims cumene hydroperoxide as an insect repellant.

Benzene Hexachloride

Insecticides have become increasingly important for our farm economy and huge amounts are sold each year. One of the best of the synthetic insecticides is the γ-isomer of benzene hexachloride (BHC) which is made by the direct chlorination of benzene. This section discusses patents dealing with BHC.

Many patents describe improvements in the chlorination process. In 2,729,603 (J. T. Clarke and S. N. Hall to the Ethyl Corp.) benzene and chlorine are reacted continuously in the presence of light to a 70-95% chlorination level in a first zone. A major portion of the product from this first zone is recycled with fresh feed while the remaining product is introduced into a second zone to complete the reaction. B. H. Nicolaisen of Olin Mathieson Chemical Corp. in 2,731,409 proposes to increase γ-isomer pro-

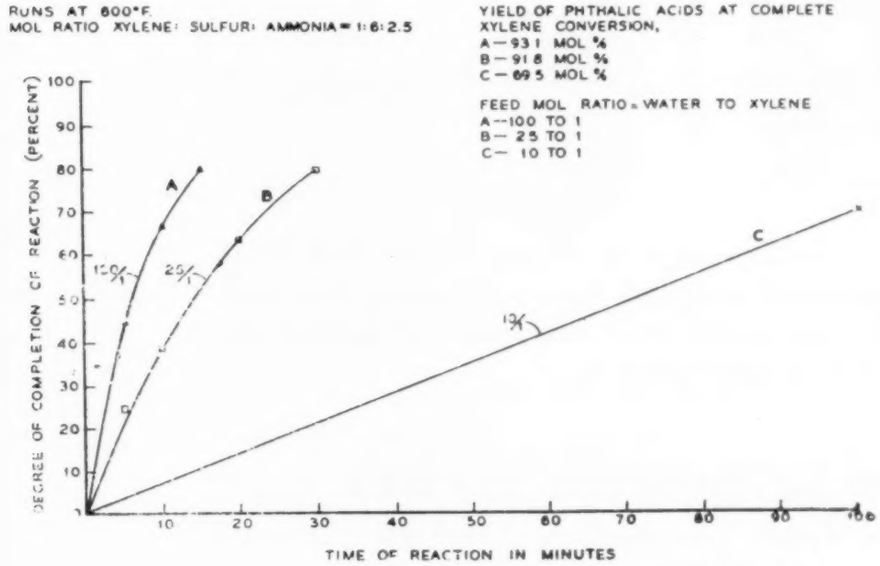
duction by chlorinating benzene in the presence of a sulfur oxychloride promoter which is present in amounts of 1-15 wt.% based on chlorine. In 2,738,320 (A. N. Johnson and P. E. Brumfield to Commercial Solvents Corp.) the photochemical chlorination of aromatics is carried out in the presence of 0.01-3.0% of a lower aliphatic, mono-hydroxy alcohol, a lower dialkyl ether, or 1,4-dioxane. The induction period is decreased and the reaction speeded by this means. F. E. Kung of Columbia-Southern Chemical Corp. (2,739,988) carries out the chlorination of benzene in the presence of trichloroacetyl peroxide. In 2,744,145, H. C. Twiehaus and Q. T. Prindle, also of Columbia-Southern Chemical Corp., state that chlorination of benzene in iron vessels has a tendency to cause substitution rather than the desired addition because of the presence of ferric chloride. They minimize this effect by using the reactants in substantially anhydrous form or with less than 50 parts per million of water. In still another Columbia-Southern patent, F. C. Dehn (2,744,146) claims that chlorination is speeded by carrying it out in the presence of an aqueous solution of a water soluble metal salt of acetic acid, e.g. potassium acetate. B. H. Nicolaisen (2,744,862 to Olin Mathieson Chemical Corp.) patents a cyclic process in which he circulates BHC in benzene between a chlorine absorption zone and a reaction zone. A minor portion of the effluent from the reaction zone then is withdrawn to product, the rest is recycled to the absorption zone where chlorine is added in amounts equal to 1-2% of the theoretical for complete conversion of the benzene.

W. A. LaLande, Jr., G. M. Knorr, and M. E. Aeugle in 2,758,077 to produce a product rich in γ-isomer by dissolving a minor proportion of benzene in carbon-tetrachloride and reacting the solution with gaseous chlorine in the presence of actinic light. Conversion of up to 60% of the benzene is obtained while maintaining the temperature below 40°C. The solid phase is removed from the effluent and γ-rich isomer is recovered from the dissolved product. In 2,758,078 these same inventors suggest the use of chloroform for this process. J. A. Neubauer, F. Strain, F. E. Kung, and W. E. Bissinger (2,765,272 to Columbia-Southern Chemical Corp.) minimize chlorine concentration fluctuations which may occur during the chlorination by maintaining in the reaction mixture a small catalytic concentration of an organic peroxide.

There are several stereo-isomers of benzene hexachloride which are obtained by chlorination; however, by far the most active insecticide is the γ-isomer and a number of patents have been issued dealing with the concentration of γ-isomer. In 2,717,233, P. W. Trotter of the Ethyl Corp. distils the isomer in the presence of triethylene glycol or glycerine to recover BHC in a plurality of fractions of different isomer content. Also, Trotter, in 2,717,272, recovers γ-isomer from the isomer mixture by heating the mixture to 30°-100°C and separating the liquid phase which contains principally the α- and γ-isomers. W. T. Donaldson and J. C. Hetrick (2,729,684 the Ethyl Corp.) concentrate γ-isomer by removing benzene from the reaction mixture to give a saturated γ-isomer solution. The separated chlorides are filtered off, further quantities of benzene are removed from the solution, and light hydrocarbons or phenol are then added. The chlorides which then precipitate are enriched in γ-BHC. In 2,760,995 (H. J. Cragg and J. H. Dunn of the Ethyl Corp.) γ-enriched mixtures are produced by partly dissolving crude BHC in a lower alcohol. The solution is crystallized to give the enriched fraction while a part of the mother liquor is recycled to the original extraction. R. D. Donaldson and R. S. Park (2,767,223 to Allied Chemical and Dye Corp.) produce γ-isomer by extracting crude BHC with a solvent comprising a lower alcohol (1-3 carbon atoms) and CCl_4. The amount of solvent used is sufficient to dissolve all of the γ-isomer but only part of the α- and β-isomers. The solution is then concentrated and cooled under specified conditions to precipitate the γ-isomer. J. T. Clarke and H. J. Cragg of the Ethyl Corp. in 2,733,102 obtain a γ-enriched mixture by treating BHC with ethylene glycol and cooling the extract to crystallize the γ-isomer. G. Galingaert of the Ethyl Corp. (2,773,103) discusses an improvement in the process of extracting crude BHC to dissolve all of the γ-isomer, leaving an undissolved residue, and recovering γ-isomer by crystallization. He suggests recycling to the original extraction the crystallization mother liquor and a substantial part of the extracted solids.

L. J. Governale (2,755,235 to the Ethyl Corp.) reduces the discoloration of BHC due to ferric chloride contamination by adding an amine of a boiling point above 150°C to the reaction mixture before removing unreacted benzene.

Some miscellaneous uses for benzene hexachlorides are discussed in the following patents. J. W. Churchill of Olin-Mathieson Chemical Corp. in 2,737,531 proposes to use as solvents the BHC obtained after separation of γ-isomer. The solvents are made by treating the residual BHC with chlorine in the presence of ferric chloride and at elevated temperatures until a substantial quantity of hexachlorobenzene is produced. Hexachlorobenzene is also made in 2,773,104 by W. B. Ligett of the Ethyl Corp. by treating BHC with chlorine in the presence of a catalyst selected from the halides or oxyhalides of antimony, iron, aluminum, arsenic, bismuth, and tin. The reaction is carried out at 200°-350°C. A. J. Kolka (2,773,105 to the Ethyl Corp.) discloses the production of trichlorobenzene enhanced in the 1,2,4-isomer by dehydrochlorination of BHC. The reaction comprises contacting BHC at temperatures above 180°C, but below the decomposition point of the trichlorobenzene, and in the presence of activated carbon.


RUNS AT 800°F.
MOL RATIO XYLENE: SULFUR: AMMONIA = 1:6:2.5
YIELD OF PHTHALIC ACIDS AT COMPLETE XYLENE CONVERSION,
A — 93.1 MOL %
B — 91.8 MOL %
C — 69.5 MOL %
FEED MOL RATIO = WATER TO XYLENE
A — 100 TO 1
B — 25 TO 1
C — 10 TO 1
DEGREE OF COMPLETION OF REACTION (PERCENT)
TIME OF REACTION IN MINUTES
A
B
C
12%
25%
13%

U.S. Patent 2,722,548: Harry J. Aroyan, Oxidation of Xylenes

END

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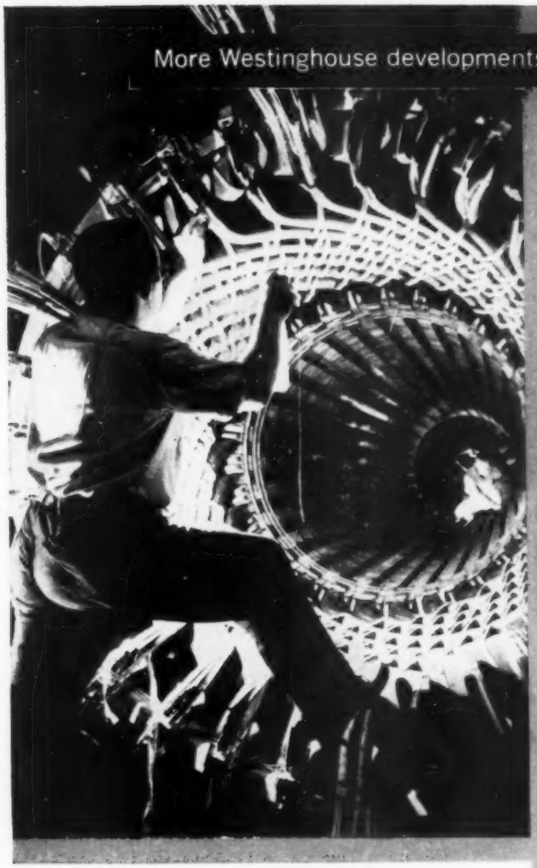

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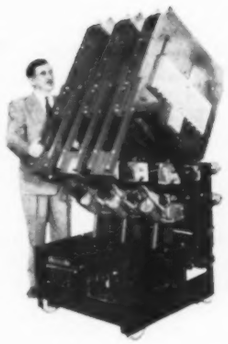

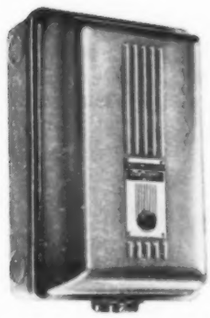

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World Review

(Continued from page 45)

by A. S. Onassis, independent tanker owner. The line would be in either three 32-inch sections or two 48-inch sections, capable of carrying about 1,100,000 b/d. The enterprise would permit passage of super tankers through the canal by allowing them to discharge their cargoes into the line at the southern end and picking them up again after transit. The proposal was submitted to the Egyptian government 14 months ago.

EUROPE

The phenomenal increase in European demand has led to several projects and companies to increase pipeline facilities. One such company is known as SAPPEUR, an acronym derived from the first letters of its name (Company for the Study and Planning of Pipeline Projects in Western Europe). It was organized by Mataafsche Petroleum Maatschappij—the operational affiliate of the Royal Dutch Sheel Group—for 99½% of the capital and the Nederlandes Internationale Ind. Handel Mij. for ½%. The latter is one of the oldest affiliates of Royal Dutch Shell Group and was originally established as an oil exploration company in 1896, although it now operates principally as a holding company.

SAPPEUR held a meeting at The Hague on September 21, 1955, at which representatives of the following oil companies were present: British Petroleum Co. Ltd.; California Texas Corp. (Caltex); Compagnie Financiere Belge des Petrolisa, S,A, (Petrofina); Compagnie Francaise des Petroles; Deutsche Erdel—A.G. (DEA); Galsenberg Banzin A.G.; Royal Dutch Shell Group; Pechelbronn S.A.F.M.; Ruhrchamie A.G.; Scholven Chemie A.G.; Socony Mobil Oil Co., Inc.; Standard Oil Co. of New Jersey; Union Rheinische Kraftstoff A.G.

The Bechtel Corp. charged with an independent study of the technical and economic practicability and the desirability of a trans-European pipeline system.

Under study is a crude pipeline of 30 inches diameter and about 600 miles in length; joining Marseille to Cologna, via Rotterdam. Branches II of smaller diameter would connect Paris and Strasbourg.

United Kingdom

The only commercial crude pipeline in the United Kingdom is a 12-in. line running from Lock Finnart on the west coast of Scotland to the Grangemouth Refinery of British Petroleum Co. Ltd. on the east coast of Scotland, a distance of 57 miles.

During World War II a network of product pipelines was laid, connecting various tanker discharge and loading stations and refineries. This network has been serviced and maintained since that time and has been added to so that it now has a total mileage of over 1,000 made up of varying distances of 6, 8, 10 and 12-in. lines. The actual layout of the system and the location of various underground storages is secret.

Certain sections of the system have been leased to the oil companies for use in distribution, with the proviso that they must be given up at once should they be required by the government. A new jetty to take large tankers is planned at Traumen on the Mercy and the building of that will entail the laying of a pipeline to Shell's Stanlow Refinery. That also is in the planning stage. No other pipelines are planned at present.

The British Parliament is now considering a bill to permit British Petroleum Co., Ltd., to build a 60-mile, 100,000-bbl. pipeline from the Llandarcey refinery to a deep-water tanker terminal the company plans for Milford Haven in Wales. The company estimates it will take two years to build the terminal and the pipeline.

France

In 1953 the French government began consideration of two large products lines, one from Marseilles refiners up through the Rhone valley toward Switzerland; the other from the refining complex located around Le Havre at the mouth of the Seine, up to the concentration of demand around Paris. The location of refineries near the coast has obviated the need for a crude line. The first of these projects is still in the planning stage; to some extent it overlaps the projected SAPPEUR arrangement. The second was completed as a 10-inch products line with about 44,000 b/d capacity in 1953. Thirty-two products are carried in the line.

The discovery of about five trillion cubic feet in 1953 by the French government at Lacq, far to the south of France has brought extensive plans for a natural gas network. Right-of-way is already being cleared for a 1,000-mile system from Lacq northward 550 miles to Paris. At about midway, near the town of Chateauroux two branch lines will go to Lyon on the east and over to the coast at Nantes. The main Paris-Lacq line will be 24 inches diameter at the southern end and 16 inches the last 250 miles to Paris. From Chateauroux a 12, 14 and 16-inch line will serve Lyon and a 10-in. line to Nantes.

Lacq gas is unusually high in sulfur content, about 18% H_2S. The resulting corrosive qualities led to considerable trouble in finding a steel capable of being used in the field without corroding. A treating plant will be installed to remove sulfur before the gas is put into the main line, however.

There is a second large gas line in France, from Saint Marcet field, east of Lacq, to St. Gaudens, Toulouse and Bordeaux. There are also two 12-inch lines supplying coke-oven and refinery gas; the former extending from the industrial area of Lorraine and the Saar to Paris, and the other to Paris from Le Havre, carrying six billion cubic feet daily of refinery gas.

A substantial network of products lines has also been laid by the U. S. Air Force and the O.T.A.N. It runs from Donges-Metz and Lavera-Langres, with a branch up to Belgium.

A pipeline has been proposed by SOPIMER, a French company, which would carry crude from Lavera to Strasbourg. The SAPPEUR line would probably take the place of this project if it goes through.

Germany

To supply growing consumption needs, six West German refiners—including affiliates of Jersey Standard and British Petroleum Co.—formed North-West Oil Pipelines Co. to build a 400,000 b/d crude line from the German port of Wilhelmshaven to refining centers in the industrial Ruhr area of West Germany. A 47.2% interest will be held by Esso AG. BP Benzin & Petroleum Co. (British Petroleum Co. subsidiary) will own about 26.3%, and the remainder will be divided among four German refiners. Shell group was originally included, but later withdrew.

Spain

There are no crude pipelines in Spain, other than local discharging lines to refineries. Products for the local market are transported via tank car and truck by the government's monopoly company, CAMPSA, to consumers. Neither are there any gas lines in the country.

There is one products pipeline for military use; a recently-constructed 485-mile products pipeline from Rota on the southwest coast, diagonally across Spain, to Zaragoza. It supplies USA air bases now being built.

Italy

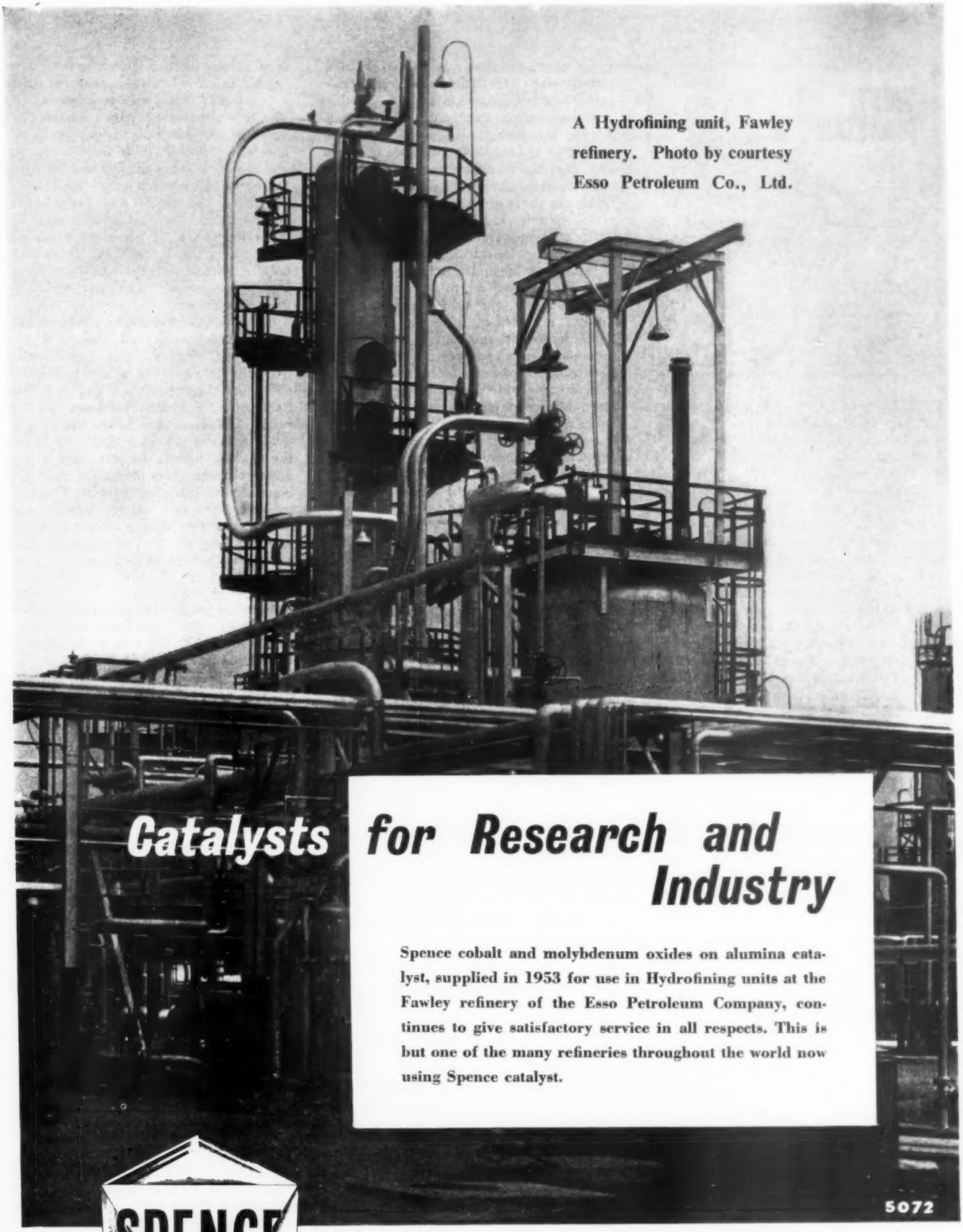
Through the efforts of the government's Ente Nazionale Idrocarburi an extensive network of natural gas pipelines has been built up in the northern part of the country. They place Italy fourth among the countries of the world in this respect. The long-distance distribution network of gas lines totaled 3,300 km., about 2,000 miles, in January of this year. To this can be added three crude lines, totaling 402 km. (241 miles), and located as follows: From Savona (sea terminal) to Trecate (SARPOM refinery), 151 km. (90 miles); from Genoa (sea terminal) to Rho (Condor refinery), 182 km. (109 miles); from Ragusa (Gulf-Italia oilfield) to Augusta (RASIOM refinery) 69 km. (41 miles).

During February, 1957, Gulf Oil Corp. announced the dedication of the Ragusa-Augusta pipeline in Sicily, under the auspices of its wholly-owned subsidiary, Gulf Italia. The 47-mile line runs across the lower end of the island. It has a capacity of 2,000,000 tons yearly (about 40,000 b/d) and is of 14-inch pipe, with one 30-inch section on the end where the crude is gravity-fed to the terminal. There are two pumping stations with National C-250 pumps pushing the heavy, 19 API gravity oil. The line's completion will enable the region's 18,000 b/d production to rise sharply during 1957.

Russia

Russia is depending increasingly on pipe line transportation for oil. At the end of 1955, some 12% of the oil load was carried by pipelines. By 1960, this proportion is planned to go up to 25%, or 26% of total oil shipments.

By the end of 1952, the pipeline network was 6,300 miles long, in which figure were included also the field gathering lines. Their diameter varied between 6 in. and 14 in.



A Hydrofining unit, Fawley refinery. Photo by courtesy Esso Petroleum Co., Ltd.

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Spence cobalt and molybdenum oxides on alumina catalyst, supplied in 1953 for use in Hydrofining units at the Fawley refinery of the Esso Petroleum Company, continues to give satisfactory service in all respects. This is but one of the many refineries throughout the world now using Spence catalyst.

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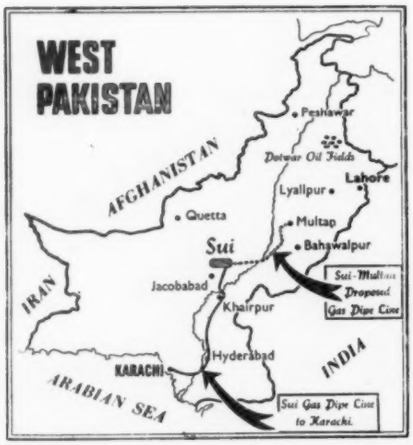

In 1953, a plan for expanding the pipe line network was the 800-mile line connecting Ufa to Omsk, commissioned late in 1955. During the sixth Five-Year Plan the network will be lengthened by an additional 9,000 miles. Hence, by 1960, the total length of the Soviet pipeline network may reach 16,300 miles. The carrying capacity of the network will go up from 8.5 million barrel-miles per day, in 1955, to 51 million barrel-miles per day in 1960.

Russia recently completed the first of two major underwater pipeline projects serving offshore Caspian oil fields near Baku. A new 3.5-mile-long line from Artyon Island to Apsheron will free Soviet tankers for other work. Construction has begun on a line running 12.5 miles from the Neftyaniye Kamny oil fields to Zhiloy Island.

AFRICA

Although the entire continent of Africa does not have a major pipeline as yet, in a recent proposal Prime Minister MacMillan was asked to set up a committee to consider building a 2,000 mile crude pipeline across Central Africa. Such a pipeline would enable Britain to draw oil from the Persian Gulf without using the Suez Canal and without the long tanker journey around the Cape.

The proposal was put by conservative member of Parliament Mr. Gerald Nabarro. He asked for a committee of Ministers of the British, Central African Federation, Tanganyikan and South and West African governments to report on the economic technical and financial considerations "Inherent in building an all British oil pipeline across Africa from Mtwara to Walvis Bay or alternative suitable route." No major companies are known to be interested in this route.

Algeria

In Algeria the discovery of substantial reserves, estimated by the French government to be capable of producing enough to satisfy the entire needs of France and the French Union within 10 years, have led to several alternative plans.

One set of plans revolves around the discovery at Hassi Messaoud, the most encouraging of recent discoveries. It is located slightly east of the center of Algeria, separated from the Mediterranean by the Double Atlas mountains. Two routes, both to rail depots, are being considered. One goes northwest to Laghouat, a distance of about 200 miles and over the area of previous oil shows near Laghouat. The other also goes north but slants eastward and goes farther, about 300 miles, to Biskra railhead.

The other set of plans is based on the discovery of oil last year at Edjele and at Tigentourine (about 50 miles west of Edjele). These areas are to be hooked up to pipeline reaching the Mediterranean via Tunisia, probably at some point between Zarzis, in Tunisia, and Zouara, in Libya. All these plans are a long way from fulfillment. The operating area is among the world's roughest; probably the construction of the Hassi Messaoud pipeline could be gotten underway immediately but the Edjele line is a major project requiring a very large expediture. Presuming sufficient reserve, the French government would consider it favorably in view of the current hazards attendant on Suez transport.

Nigeria

Shell-BP recent discovery in Nigeria, the culmination of a long and expensive campaign still has not been proved commercial. The company plans to begin test production in the middle of 1957. Oil will initially be transported by 200-ton barges to Port Harcourt from Oleibiri. However, the capacity of this transport route is not capable of expansion since this is the maximum size of barge which can navigate the creeks near Oleibiri. Consequently, Shell-BP intend to lay a 10-inch diameter line seven miles in length which will allow production-testing to be speeded up.

Appraisal of the AFAM structure which lies 25 miles east of Port Harcourt is at a much less developed stage than Oleibiri and the decision regarding the construction of the AFAM line cannot be made at the moment. However, the proposed survey will enable the pipeline to be constructed without delay should present drilling be successful.

These small diameter pipelines will not necessarily be permanent. Should commercial quantities eventually be proved it may be necessary to construct pipelines to a point other than Port Harcourt in order to export the oil in fully loaded tankers, according to the company. Shell-BP Petroleum Development Co. of Nigeria Ltd., recently requested permits to survey routes for these two pipelines in eastern Nigeria under the terms of the new oil pipelines ordinance.

ASIA

Pakistan

Where there are no crude pipelines of importance in Pakistan, there is a major gas line in operation and another presently being constructed. The existing line is the Sui gas line, which is 348 miles long, 16 in. in diameter, has a capacity of 110 million Transmission Co. Ltd. A second 16-inch line is now being built to Multan in the Punjab region. This line is wholly sponsored by the government's Industrial Development Corp. The line is being built by Pakistan Constructors, an American company, and about one-fifth of the 217-mile Sui-Multan line had been finished at the end of 1956. Actually about 70% of work on the line has been completed. The original schedule called for completion this May, but the Suez crisis delayed the arrival of necessary equipment for crossing the Indus River (which can only be accomplished during the dry winter season) and completion will now be delayed until next winter.

Both the Sui lines are in West Pakistan, which is separated by more than 1,000 miles and the width of India from East Pakistan. Recently the discovery of about 70 billion cubic feet of gas reserve at Sylhet in East Pakistan by Pakistan Petroleum Ltd. has raised the subject of a gas line there also.

To transport gas from Sylhet to Dacca, the nearest market, would require a high pressure transmission pipeline of eight inch diameter and 145 miles in length. This provides for a maximum ultimate capacity of 24 million cubic feet per day without compressors assuring an inlet pressure of 1,200 pounds per square inch gauge.

India

There are no important crude or natural gas lines in India at present, but a proposal for a 820-mile line is now being debated. The line would carry crude from the newly-discovered Naharkatiya, in Assam, to a government-owned refinery to be built in Calcutta. The project under study at present involves use of the Brahmaputra River to take oil from Naharkatiya, which lies in the extreme east of India and is separated from the main part of the country by East Pakistan. The oil would go only as far as Dhubri via the river tankers and barges; there it would be placed in a 400-mile pipeline which would take it to Calcutta, since the Brahmaputra passes through East Pakistan and also becomes more difficult to navigate. An alternative proposal would lay a single pipeline all the way from Naharkatiya to Calcutta.

Indonesia

The major recent pipeline development has been the construction of a 90-mile crude line to deep water from Lirik field of central Sumatra, by Standard Vacuum. The line is heated to keep the crude—which is waxy and has the extremely high pour point of 105 F—flowing. The line will be complete during 1958, and will have a capacity of 20,000 b/d.

LATIN AMERICA

Mexico

Major crude lines have been built from Minatitlan to Saline Cruz, from Salamanca to Morelia, Salamanca to Lagos-Guadalajara and Aguascalientes, as well as that under construction from Tampico to Victoria and Monterrey. A pipeline is planned from Guaymas to Obregon City and Navo-

(*Continued on page 73*)

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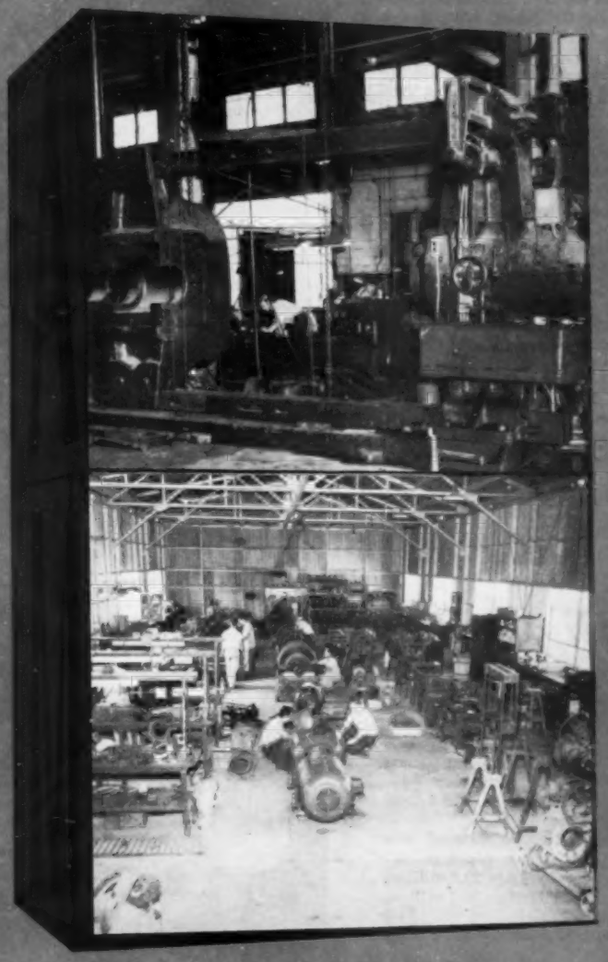

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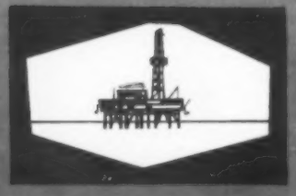

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CAMERON DEDICATES NEW TYPE GASKET PATENTS TO INDUSTRY

Herbert Allen, vice president and general manager of Cameron Iron Works, Inc. Houston, has announced the development of a new self-sealing ring gasket for API flanged connections. This new design has eliminated most of the headaches and hazards so prevalent with the old style oval or octagonal API gaskets.

Cameron does not manufacture ring gaskets but is one of the industry's largest users. Because of the great benefits which will come from its widespread acceptance among Cameron's customers and the industry in general, this new gasket is being released to the industry royalty-free.

The Cameron design development group while working with flanges for extreme high pressures noticed a self-sealing effect in special rings being used in tests. Almost all Cameron products use flanged connections and as development work progressed in several lines, rings were altered to increase the self-sealing effect and to combat gasket failures from drilling vibrations, test load shocks, etc. The result of this "side line" design work is a gasket which uses internal pressures to assist sealing effect, requires far less make-up time, no retightening, and offers a degree of safety not possible with present API gaskets.

In section the new gasket is taller than the conventional API oval gasket and has large flats which mate with the standard groove preparations. As flanges are made up, the flats on the outside diameter of the self-sealing ring gasket make contact with the groove first. This causes the self-sealing gasket to be pre-loaded against the groove's outer surfaces as the flanges are brought together. This pre-loading is stopped when the ring's inner surfaces come in contact with the inner surfaces of the groove. This insures proper alignment and stopping, and offers maximum resistance to external forces. The ratio of ring height to the width of the bearing of the ring's outer surfaces in the groove has been increased so that a selfsealing condition exists. It has been found that the ratio of ring height to bearing width must be 3-to-1 or greater for a self-sealing effect. Only standard API stud lengths are necessary with the increased height of the new self-sealing ring gasket. Ring groove condition is not critical.

Standard API Oval or Octagonal Ring Gaskets. Stud bolts used with standard API oval or octagonal ring gaskets must perform the double duty of holding pressure while keeping the gasket compressed. When making up a joint, the curved surface of the relatively soft oval ring gasket is mated with the flat surfaces of the hard flange groove. A small flat is pressed on the curved section of the oval ring. The size of this flat depends on the bolting make-up tightness. As normal tightening proceeds forces accumulate and deform the ring to produce a seal. By the time all bolts around the flange have been tightened, the first bolt is loose again. In most API flanged connections, it is necessary to tighten bolts around the flange several times to reach a stable condition. On larger flanges this may take over an hour of expensive rig time. When internal pressure forces become great enough to cause flexing in an API joint using an oval or octagonal gasket, the bolting contact force on the seal ring begins to decrease. If flange separation exceeds the limited resilience of the seal, leakage will occur. External shock loads such as drilling vibration add to the compressive loading of the stud bolts to further deform the API gaskets, cause leaks and make repeated tightening necessary. The two basic faults of both oval and octagonal API seal ring designs is that they cannot withstand external loads properly and that internal pressure does not assist their sealing ability.

The New Self-Sealing Ring Gasket. The self-sealing ring gasket as developed by Cameron solves these difficulties. Stud bolts need be tightened only once around to pre-load the gasket and start the self-sealing effect. Vibration during drilling operations which normally puts destructive stresses on API rings in drilling control hook-ups does not effect bolt tension or gasket seal. Rough handling of Christmas Trees in shipment or extreme test pressure shocks do not necessitate retightening of stud bolts. This, of course, means a big saving in time and effort. It also means safer working conditions—especially important offshore.

Cameron has made numerous tests under many conditions to test the efficiency of these pressure energized gaskets. In each case they formed a safer seal with only a fraction of the bolt tightness required by the conventional oval gasket. For example, one Cameron gasket made up in a 2-in. API 5,000 psi cwp flange with a bolt tightness of 220 ft. pounds held pressures up to 30,000 psi without leakage.

Along with every other member of the industry, Cameron has been concerned with the problem of maintaining tight API flange connections. The success of the self-sealing ring gasket design developed by Cameron indicates the end of the many problems arising from the rhw API gasket.

This new type self-sealing ring gasket saves hours and hours of nipple up-time and insures a tight connection under most adverse circumstances, which in turn will save dollars, property and lives for the oil industry as a whole.

Fig. 1. Diagram showing cross sections and lines of force on new Cameron gasket, compared with API standard gasket.

A. The small curved contact areas of the old style ring gasket effect a seal only with high bolt loading. Because they yield under load, continuous retightening is necessary. Internal pressure does not aid in maintaining a seal.

B. The "Self-Sealing" Ring Gasket utilizes the force of internal pressures to "increase sealing effect over the two broad surfaces on its outside diameter. Contact areas with the flange groove are increased tremendously. The result is better sealing effect and much greater load carrying ability.

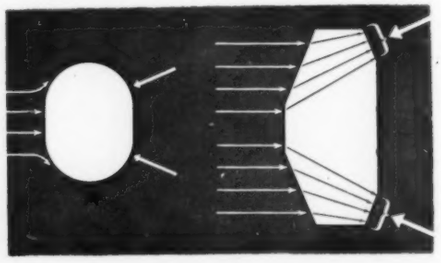

Fig. 2. Photograph of new Cameron gasket.

U. S. and Canadian Reserves Higher

United States and Canadian reserves of crude petroleum and natural gas liquids increased substantially in 1956 according to estimates prepared by committees of the American Petroleum Institute, the American Gas Association and the Canadian Petroleum Association.

For the second consecutive year Canada found about three times as much oil and natural gas liquids as was produced. In the case of crude oil Canadian discoveries totaled 509 million barrels and production 169 million. Natural gas liquids discoveries totaled 35.5 million barrels and production 2.7 million barrels. Total liquid reserves in Canada at the end of the year totaled 3,129 million barrels compared with 2,757 million a year ago.

In the United States crude oil reserves increased 422 million barrels and natural gas liquids 464 million barrels compared with 35,451 million a year ago. The increase in crude reserves was less than in 1955 but that of natural gas liquids was much larger.

Natural gas reserves in the United States totaled 237.8 trillion cubic feet compared with 223.7 trillion at the end of 1955. Production totaled 10.9 trillion cubic feet and discoveries 24.98 trillion cubic feet.

Crude oil reserves in the United States rose 422.5 million barrels in 1956 to 30.4 billion barrels. Outside of Louisiana with its growing offshore reserves there was a net increase of only two million barrels in the country. Louisiana found 690 million barrels of new oil and produced 270 million barrels.

Texas continued to lose ground as it has for the past five years. At the end of 1951 Texas reported reserves of 15.3 million barrels and last December 31 the total was down to 14.8 billion barrels a loss averaging 100 million barrels per year. In 1956 Texas produced 150.4 million barrels more than was found. Substantial losses in reserves also were suffered by Arkansas, California, Kansas, Mississippi and Wyoming.

Outside of Louisiana much of the new oil was found in the Rocky Mountain area. Montana reserves rose 32 million barrels, Colorado 29.7 million, New Mexico 15.8 million, North Dakota 10.3 million and Utah 24.3 million barrels.

The following tabulation is a summary of changes in reserves:

U.S. RESERVES—LIQUID HYDROCARBON
(Thousands of Barrels)

Commodity	*12/31/55*	*12/31/56*	*Increase*
Crude oil	30,012,170	30,434,649	422,479
Nat. gas liquids	5,438,565	5,902,332	463,767
Total liquids	35,450,735	36,336,981	886,246
NATURAL GAS (MILLIONS OF CUBIC FEET)			
Natural gas	223,697,445	237,774,569	14,077,124

CANADIAN RESERVE—LIQUID HYDROCARBON
(Thousands of Barrels)

Crude oil	2,509,534	2,849,370	339,836
Nat. gas liquids	247,085	279,934	32,849
Total liquids	2,756,619	3,129,304	372,685

World Review

(*Continued from page 70*)

joa, another between Guaymas and Hermosillo, and prolongation of the Tampico-Monterrey line to Torreon.

Total mileage of oil and gas lines is 3,656, of which 1,118 were laid during the past four years.

Bolivia

A network of crude pipelines has been built within Bolivia connecting Cochabamba and Sucre refineries with Camiri. In addition, construction of one 6-in. pipeline of about 30,000 b/d capacity was completed in 1955 from the Camiri field to Yacuiba on the Argentine border; another, from Cochabamba to La Paz, is being constructed with an extension to Chile. An agreement was recently reached with Paraguay for the construction of a 780-km pipeline (468 miles) from Bolivian fields to the River Paraguay. The first 130 km are to be financed by the Bolivian government, the remainder by the government of Paraguay.

Brazil

There is only one crude pipeline, completed in 1956. The 6-in. line, 32.4 miles long, was inaugurated on May 10. It starts at the Catu field, traverses Pojuca and Mata de Sao Joao fields, and continues to Candeias field and Mataripe refinery.

There are two 10¾-in. lines from Alamoa to Cutatao station; one of 10¾-in. diameter from Cubatao to the terminal at Utinga; two 6⅝-in. lines between Utinga and Mooca; one 18-in. line between Alamoa and Utinga; and one 14-in. line from Utinga to Mooca, a suburb of Sao Paulo. Another branch connects with the Uniao refinery.

Chile

There are no major lines in the country, other than one 8-in. line from a marine terminal to Manantiales field in the Tierra del Fuego area; one 6-in. line for crude from Manantiales to Victoria Sur field (paralleled by a gas line); and one other 6-in. line from Sombrero field to Chillian and then to Cullen fields.

Colombia

There are four major crude pipelines in Colombia. The most important crude line runs from El Centro in De Mares concession to Mamonal on the Atlantic coast. It is 10 in. in diameter, except for one 34-mile stretch of 12 in., and has a capacity of 70,000 b/d. Owner is Andian National Corporation Ltd., an affiliate of Standard Oil (New Jersey). Two feeder lines, respectively of 50,000 and 8,000-12,000 b/d capacity, connect with Yondo and El Dificil concessions.

The second line is owned by South American Gulf Oil Co. (SAGOC), an affiliate of Socony Mobil and The Texas Co. It runs 263 miles from Petrolea field in the Barco concession to Covenas on the Atlantic near Cartagena, and has 28,000 b/d capacity, with a diameter of 12 in. Another line runs from Texas' Velasquez field to the Intercol's refinery at La Dorada with a capacity of 4,500 b/d, capable of being raised to 5,000 b/d with a pumping station added. It is of two loops, one 4-in. and one 6-in. Another line of 4-in. diameter runs from the Tetuan concession to a small topping plant at Guamo from Texas Co.'s Ortega field.

Venezuela

There was a total of 2,116 miles of pipelines in Venezuela, with a total capacity of 5,084,293 b/d as of January 1, 1955. The majority of these pipelines are for the transportation of petroleum from the Lake Maracaibo region to the coast, and from the eastern fields to the coast around Puerto La Cruz.

Recent discoveries in the Barinas area, located in the extreme south and west of the country, have led to a pipeline by the exploring companies; Sinclair Oil Co. and Socony Mobil Oil Co. The cost of a pipeline from this area is estimated at around $25 million, and the companies currently are building a 240-mile line to the coast, now half completed.

NORTH AMERICA

Canada

Total pipeline mileage in Canada at the end of 1956 was approximately 5,502 miles, including both oil and gas. There are two major pipelines. Interprovincial Pipe Line, varying from 20 in. to 16 in. in diameter, runs from Edmonton, Alberta, to Superior, Wis.

The second major crude line is the Trans Mountain pipeline from Edmonton to British Columbia, a distance of 718 miles. This line is 24 in. in diameter. Deliveries for the month of March, 1957 are anticipated to be 175,000 b/d, and the company's construction program for 1957 to increase the system's capacity to 240,000 b/d has begun.

There are two large gas pipelines constructing. The largest is by Trans-Canada Pipe Lines Ltd. Plans call for a 36-in. pipe line from Alberta to Winnipeg and, from Winnipeg, a 24-in. lateral southward to Minnesota, with a 30-in. line to extend eastward to Ontario and Quebec. Planned capacity of this line is 540 million cubic ft daily, which is to be drawn from a wide network of feeder lines within Alberta, costing about US $300 million. By the end of 1957, almost a 60% of the 2,294-mile, all-Canadian natural gas pipeline will be complete.

The other gas line is by Westcoast Transmission Co., which is building a line 650 miles from Peace River in north British Columbia to the USA, almost complete.

Alaska

There is only one pipeline now in Alaska, a 12,000 b/d products line which was completed during 1955 from Haines, on the coast of the Alaskan panhandle, to Fairbanks.

United States

Mileage of crude and products pipelines in the U.S. on January 1, 1956, was 188,540 miles. This does not include gas lines, which totaled 524,800 miles including LPGas; manufactured gas; etc. There were 485,810 miles of natural gas line in the U.S. at the end of 1956.

The recent Suez crisis pointed up the shortage in U.S. pipeline transportation to the Gulf Coast, especially when the shortage of pipeline space prevented needed crude from reaching the coast. There is a considerable amount of new construction to be done; when hooked up with mounting demand it is estimated that an increase of 73.7% will be needed in transportation facilities (as a minimum) by 1965.

The Four-Corners Pipe Line Co. has been established to construct a 600-mile crude-oil line starting at the Four-Corners area of Utah and terminating at Los Angeles. Organization is a crystallization of plans first announced in October 1956. The following companies participate: Continental Pipe Line Co., 10%; Gulf Oil Corp., 20%; Richfield Oil Corp., 10%; Shell Oil Company, 25%; and the Superior Oil Co., 10%. R. G. McIntyre was elected president.

Tanker and Cathodic

(*Continued from page 47*)

a number of tanker operators have been quick to appreciate the value of hull preservation below the water line by the application of cathodic protection. A number of vessels are already at sea with cathodic protection fulfilling a dual role of internal and external corrosion prevention.

External systems have again tended toward the use of sacrificial magnesium anodes in preference to the use of the so-called impressed current systems which usually employ inert anodes fed by direct current from an external source. This arises from the extreme simplicity, robust construction, and automatic operation of the galvanic system.

In a tanker equipped with a galvanic protection scheme, the anode groups are arranged in predetermined positions along the hull to give equal distribution of protective current to all the submersed areas. There is usually, in addition, a tendency to concentrate extra anode groups in the stern areas to overcome galvanic action between the hull, stern gear, and propeller—particularly when the latter are of dissimilar metals.

Conditions of service again have a considerable effect upon design. Vessels which spend the greater part of their life at sea—and the ocean-going tanker certainly falls in this category—are likely to demand more from their protective systems than those frequently at rest in ports, which may be largely fresh-water. For this reason, approximate lives for external hull protection schemes are usually 18 months to 2 years before the renewal of anodes is necessary.

Dealing with the material advantages, an efficient scheme will maintain a hull virtually corrosion-free so long as the anodes are renewed at the stated interval—and this for a matter of a few hundred pounds' capital outlay only.

In addition to the obvious savings of rivet and plate renewals, there is the lesser water resistance of the unpitted hull, economy in fuel consumption which arises from this, and also the prospect of extending the periods between dry-dockings and the application of anti-corrosive paints.

All these factors assume roles of some significance when related to the ultimate object of operating the tanker for the maximum earning time at the minimum cost.

END

London Letter

By E. Lawson Lomax

Despite more imports from the Western Hemisphere, conditions are still very tight. Industry is suffering from the shortage—especially acute in fuel consumed by bunkers.

According to the Chamber of Shipping of the United Kingdom, of 1,994 vessels engaged in foreign trade (on June 30, 1956), 1,938 were either diesel or oil-fired. In addition, there were 718 oil-fired vessels engaged in coasting and home trade.

In order that the trade of the country may be carried on, with no dimunition of exports and imports, these oil-fired vessels must have their full quota of fuel. In industry, fuel oil can be replaced by coal. Therefore, the more pressing need of the UK and Europe in general is for fuel oils and, with fuel oil, lubricants.

Diesel oil and gasoline are practically as important as the bunker trade; but, in road transport, fuel is not too tight, and most users are able to obtain their full requirements.

In the light-goods transport, business cars, and pleasure-car section, conditions are much tighter; and only a small percentage of this class of user is getting its full requirements. This, however, is not a serious matter.

Record UK Equipment Sales

The Council of British Manufacturers of Petroleum Equipment has published its quarterly report on the value of orders for materials and equipment placed in the UK by the oil companies during the last quarter of 1956. They amounted to £39,509,573—£9 million more than in the equivaelnt period of 1955. Total for the year amounted to £153,680,621—£30 million over 1955. The amount has almost doubled in six years.

Some of the larger figures making up this amount are as follows: tubulars, pipe fittings, and valves—£38,705,000; drilling and production equipment—£15,218,000; tools and machinery—£10,069,000; tankage—£8,081,000. This sum of over £153 million does not include any of the cost of tanker building in the country, of which 46 were launched during the year.

VALUE OF ORDERS FOR MATERIALS AND EQUIPMENT PLACED IN THE UNITED KINGDOM BY OIL COMPANIES DURING PERIOD 4 (October-December 1956)

(Compiled by the Oil Companies Materials Secretariat)

	Pounds Sterling	1955 (Period 4) *Pounds Sterling*
Geophysical and other exploratory equipment, etc.	25,751	9,527
Specialized equipment for oil drilling and production, including oil casing, tubing, etc.	4,119,878	3,041,895
Specialized equipment for oil refineries, etc. (not including pumps and valves)	1,226,379	916,269
Drum- and can-making, filling, and cleaning equipment; curbside pumps and other oil metering and dispersing equipment, etc.	191,100	216,221
Rail cars, road tankers, aircraft refuellers, etc.	35,564	18,890
Drums, drum sheets, and tinplate	1,976,841	2,176,021
Tankage (including tank fittings)	2,643,078	1,413,325
Tubulars, pipe fittings, and valves (ferrous and non-ferrous)	8,771,155	4,543,997
Pumps (excluding slush, oil-well, and curbside)	608,095	530,440
Boilers, boiler-house plant, and accessories, etc.	104,334	117,831
Electrical equipment—motors, generators, transformers, etc.	2,170,014	1,279,205
Instruments, meters, and gauges, etc.	500,842	408,589
Prime movers and compressors	1,045,936	714,755
Machine and hand tools; welding and miscellaneous machinery and stores	2,530,861	2,646,480
Ferrous and non-ferrous plates, sections, sheets, and bars	1,494,876	971,929
Automotive equipment—all types	2,120,353	2,329,911
Laboratory equipment and chemicals, including hospital and medical supplies	257,172	297,956
Bulk chemicals, catalysts, barytes, etc.	6,148,297	5,850,013
Cement and other building materials, and hardware—including timber	2,086,321	1,072,312
Commissary; general requisites for office, warehouse, household, club and sports, etc.	1,451,726	1,821,118
Total	£39,509,573	£30,435,698
Totals: 1956	£153,680,621	
1955	£123,525,788	
Period 3, 1956	£ 39,448,153	

Institute of Petroleum Dinner

The annual dinner of the Institute of Petroleum was held, February 20, 1957, under the chairmanship of the Right Honorable Lord Geddes, president of the Institute of Petroleum. Attendance was nearly 1,350. Principal guest of the evening was Sir John Maud, permanent secretary of the Ministry of Power, who proposed the toast to the petroleum industry and the Institute of Petroleum. He especially mentioned the spirit of cooperation shown by the petroleum companies in America and England, together with the representatives of the 17 countries who—with the petroleum engineering group led by Mr. Berkin—had regularly met in Paris to solve the problems created by the Suez Canal crisis and the sabotage of the pumphouses and pipelines in Syria.

Lord Geddes, in his reply—after having thanked Sir John Maud—gave a brief account of the year's working of the Institute and its various activities—followed by a resume of the events following the Suez Canal crisis, and also the effect of this crisis on Far Eastern trade—after which he proposed the toast to the guests, which was ably responded to by General Sir Neville Brownjohn, KCB, Quartermaster General to the Forces.

Water-Gas Process for Shell Haven

NV de Bataafsche Petroleum Mij., of the Royal Dutch Shell group, has developed a pressure process for the production of water gas from any hydrocarbon, from gas to heavy fuel oil, as a base material, which offers a flexible and economically attractive new technique. The first commercial unit is operating successfully at Ijmuiden, West Haarlem, Holland, and a further plant is now being built at Shell Haven to manufacture gas for use in the new £6 million plant now under construction for the large-scale production of nitric acid and ammonia. The water-gas plant is due for completion in August 1958, and its intake of hydrocarbons will be about 200 tons per day.

Exploration in the UK

British Petroleum Co. has three seismic reflection parties working in England. Two of these parties are working on contract for BP—the third being the company's own staff. One of the areas concerned is at Ellenthorpe, east of Boroughbridge, in a triangle bounded by the towns of Easingwold and York. An earlier reconnaissance was carried out in this location in 1945. The other areas are at Widmerpool, west of the Plunger field, Leicestershire, and an area between Retford and Gainsborough, west of the River Trent.

New Chemical Plants in Operation

Two new plants for the production of chemicals from petroleum have been started up at the Grangemouth (Scotland) works of the British Hydrocarbon Chemicals Ltd. They are for the production of ethylene and ethanol (industrial alcohol), and have doubled the production of these chemicals at this plant. They are part of an £8 million expansion program announced in 1955.

New Mobile Platform for Venezuela: A new type mobile platform for overhead working recently was shipped to Compania Shell de Venezuela's Cardon refinery. Known as a Simon hydraulic platform, it can be extended at a speed of more than 40 ft per min to any desired working position with a maximum height of 40 ft and a reach of 25 ft; is electrically insulated up to 500 volts; and will be used for maintenance of overhead power lines, telephone wires, and refinery units.

New Turbine-Fuel Water Test

An excess of water in an aviation turbine fuel can be very dangerous, depending to a certain extent on the amount present. Water settles out rapidly from gasoline, as the viscosity and specific gravity are low, but not so readily from turbine fuel.

A new method has been devised at Shell's Thornton Research Laboratory which is capable of detecting as little as 0.003% of undissolved water in the fuel. As the Viscount 700 fuel system will function satisfactorily with fuel containing up to 0.02% by weight of dissolved water, plus 0.02% by weight of free dispersed water, the new detector provides a satisfactory margin.

The action depends on drawing a 5-ml sample of the fuel through a detector head in which is an exposed area of sensitized paper through which the fuel will flow. The presence of water and the amount present is indicated by a color change in the sensitized paper. The change is progressive between 0.003% and 0.01% of water.

New Tankers

Mssrs. Cammell Laird and Co. Ltd., Birkenhead, announce that the 18,000 dwt turbine tanker "Hemisinus," built to the order of Shell Tankers Ltd., was launched February 15, 1957.

The 36,000 dwt turbine tanker "Storfonn," built by Harland and Wolff Ltd. at Belfast for Sigval Bergesen and their associated companies, successfully passed its sea trials on January 31, 1957.

The 32,000 dwt turbine-driven tanker "Arabian Gulf," built by Furness Shipbuilding Co. Ltd. at its Haverton Hill shipyard for the Afran Transport Co. of Liberia (Gulf Oil Corp., New York), passed its sea trials on February 20.

Messrs. Vickers-Armstrongs Ltd. are now examining the possibility of building oil tankers of between 85,000 dwt and 100,000 dwt at their Barrow shipyard, and also of increasing drydock facilities to service this size of vessel. At present, the firm has orders for 5 tankers—two of 42,000 dwt and three of nearly 50,000 dwt—although the size of one of the latter may eventually be increased to 65,000 dwt.

Finance for British Tankers Ltd.

Negotiations are in hand for the provision of large-scale finance by the city, in connection with the provision of tankers for British Tankers Ltd. on somewhat similar lines to the recent £30 million finance arranged for Shell Tankers Ltd. The Ship Mortgage Finance Co., formed in 1951, will be an active member of the scheme, and the amount of finance is £40 million, applying to the present building program of British Tankers Ltd. END

BP FUELS NORWAY'S FISHING FLEETS

THESE NORWEGIAN fishing boats are often out in the fishing grounds for weeks on end, covering many hundreds of miles during their stay at sea. On their return to their home fiords, the catch is landed, nets are repaired, and at places all along Norway's coasts BP oil fuel is pumped into the boats' fuel tanks.

The BP Shield is a familiar sight from the Arctic to the Antarctic. At sea, on land and in the air, BP makes an ever-growing contribution to the work and well-being of mankind.

The BP Shield is the symbol of the world-wide organisation of

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International News and Notes

Gulf Italia Dedicates New Pipeline In Sicily

Gulf Oil Corp. announced that the official dedication of the Ragusa-Augusta pipeline in Sicily had taken place under the auspices of its wholly owned subsidiary, Gulf Italia. Those present at the ceremonies in February, held at both ends of the 40-mile pipeline which runs across the lower end of the island northeast from Ragusa to Augusta, were: Hon. Giuseppe La Loggia, president of the Sicilian government; Hon. John D. Jernegan, American minister in Rome; C. W. Hamilton, Gulf Eastern Co., chairman; and representatives of NATO, the Sicilian government, and Italian industries.

The opening of the new pipeline will increase sharply the production of the Ragusa field, currently producing 18,000 b/d. It follows Gulf's recently announced decision to withdraw from all oil exploration activities on the mainland of Italy. The decision to withdraw resulted from the passage of the unattractive hydrocarbons bill by the Italian parliament. Sicily's regional oil law of 1950 is more attractive to private enterprise than the new mainland law.

In addition to the Ragusa-Augusta pipeline, Gulf Italia's exploration activities elsewhere in Sicily are expected to go forward at an accelerated rate.

ICA Guaranty For Jordan Oil Development

International Cooperation Administration announced issuance of a guaranty covering an estimated $6-million investment by Edwin W. Pauley, Los Angeles independent oil producer, in oil exploration in the Hashemite Kingdom of Jordon. An agreement with the government of Jordan effected last year gave Mr. Pauley rights to explore and drill for petroleum, natural gas, and other hydrocarbons in an area comprising one-third of the 37,000 square-mile Middle East kingdom.

The insurance issued by ICA would provide reinbursement for loss suffered by Mr. Pauley if his investment property should be expropriated. Maximum guaranty is $1.5 million for 1st year, $3 million for 2nd, and $6 million from the 3rd through the 20th year. The maximum limits represent cumulative totals of investment by Mr. Pauley planned over a 3-year period ending December 31, 1959.

The guaranty issued to Mr. Pauley is the first such ICA contract to cover an investment in Jordan since that kingdom agreed to cooperate in the US investment guaranty program of September 24, 1956. It is also the first such contract made to protect a USA investment in a project abroad for exploring and drilling for petroleum.

Kuwait Exports Drop 53%

US government sources report that crude-oil exports from Kuwait dropped 53% in November 1956, when the Suez Canal was shut down. Neutral Zone exports dropped 48%, to 0.85 million barrels for the month.

Exports from Kuwait, by the Kuwait Oil Co., were 17,255,228 bbl in November, making an 11-month total of 366,499,444 bbl. Distillate exports from Kuwait were 101,005 bbl for November—an 11-month total of 837,671 bbl.

American Oil Co. exported from the Saudi Arabia Neutral Zone in November 432,635 bbl of crude, making an 11-month total of 5,250,157. Getty Oil Co. exported from the Neutral Zone 421,403 bbl of crude in November—an 11-month total of 5,581,809.

Kuwait Oil Co. Discovery

Kuwait Oil Co. Ltd., London, has reported further developments in exploratory drilling based on seismographic surveys made in northern Kuwait during 1956.

Sabriya No. 1, nine miles southeast of the area's discovery well at Raudhatain No. 1, which is 60 miles north of the present producing area, was spudded in, August 11. By the end of December, it had reached a depth of 8,450 ft with 7-in. casing cemented at 8,437 ft. It is intended to deepen this well to explore the Zubair sands.

Bahra No. 2, 10½ miles south of Sabriya No. 1, was drilled to a depth of 8,488 ft with 7-in. casing cemented at 7,789 ft. This well is now closed in.

The first announcement concerning discovery of oil in northern Kuwait was made early last year following the drilling of a test well at Raudhatain No. 1 and the spudding in of a well at Raudhatain No. 2, 1.8 miles distant. The second well, part of the exploratory program designed to investigate the extent of the new field and the commercial value of the discovery, was drilled to a depth of 9,695 ft, and 7-in. casing was cemented at 8,778 ft. Production facilities not being available in the northern area, this well was also closed in.

The Kuwait Oil Co. is owned equally by Gulf Oil Corp., Pittsburgh, and the British Petroleum Co. Ltd., London.

New Drilling Firm in Australia

Joseph L. Hargrove, partner in Hargrove Oil and Gas Co., has left for Australia, where he will supervise drilling operations for a new company. He will be associated with South Pacific Co. Ltd., an Australian corporation, as vice president and director. The new company will conduct drilling operations in the Mantuan Downs concession, which comprises 7,000 square miles (4,480,000 acres) in the Australian state of Queensland, some 450 air-miles from Brisbane.

Austria's 1957 Oil Investments

The 1957 investment program of the Austrian Mineral Oil Adminstration Comp. (OeMV-AG) provides for a total expenditure of $27,493,884.

One hundred twenty-five production wells, with a total footage of 630,149, are to be drilled at an investment of $10,890,000. One hundred nineteen production wells are to be drilled in Matzen, Austria's most productive field. Twenty-three wells, directionally drilled by turbo-drills, are to gain access to oil deposits under the villages of Reyersdorf, Schonkirchen, Bockfliess, and Prottes. $2.76 million are to be spent for 22 exploration wells with a total footage of 155,191. $152,000 is earmarked for 10 formation drillings of a total footage of 22,967. By these investments, a production of some 62,000 b/d of crude is to be guaranteed for 1957, while equipment is being modernized and productivity stepped up.

In refining, $14,080,000 are to be spent within the next two years for building of a reforming plant, two LPGas plants, and a paraffin-stripping plant to cut imports of high-octane gasoline and high-quality lubricants. The Moosbierbaum refinery is to be connected with a crude and products pipeline to the existing pipeline system. The share of investments in 1957 is to amount to $5,462,000.

Four wells are to be drilled in the gas field at Zwerndorf to raise the field's daily output to 53 mmcf. A total daily production of 28 to 35 mmcf of gas is envisaged for 1957. Refineries in Schwechat, Lobau, and Vosendorf are to shift to gas as fuel, thus freeing about 2,000 b/d of fuel oil per year for the domestic market. Remaining investments go to modernization and rationalization.

The dispute between OeMV-AG and the NIOGAS Co. of Lower Austria province was settled at the end of January 1957, by an agreement under which NIOGAS renounced its oil and gas concession (exploration and exploitation) in Lower Austria in exchange for a number of privileges, including the monopoly for natural-gas distribution in this province. In return, OeMV-AG is to be granted new concessions.

Besides the natural-gas monopoly, NIOGAS was granted by the OeMV-AG a $25 million loan and, in addition the delivery of 14 mmmcf of natural gas annually for a period of 10 years at one-half the normal price—which amounts to an annual subsidy of about $2.3 million.

After having suspended activity in Austria in 1945, when Russians confiscated the equipment, Societe de Prospection Electrique (Procedes Schlumberger) again had its firm name entered in the Austrian trade register. The firm intends to train Austrian engineers to replace, in time, the present French supervisors. The firm will supply its patents in the exploration of the subsoil.

Creole Movie Highlights Venezuelan Culture

"Assignment: Venezuela"—produced by Creole Petroleum Corp., Venezuelan affiliate of Standard Oil Co. (New Jersey)—was released for USA audiences at a premiere held at the Johnny Victor Theater in New York, early in February.

The motion picture is a 24-min sound film in color which depicts the life of a young petroleum engineer from the USA who takes an assignment with Creole in Venezuela. It not only shows how he adjusts to his work in a foreign country, but also illustrates much of the environment of his new "home"—including many of the highlights of Venezuela's cultural and economic way of life. This film supplements "People and Petroleum," a black-and-white picture released last year by Creole as a documentation of the economic development of Venezuela and the part played therein by the oil industry.

Brazil To Produce Ethylene

Part of the equipment for the ethylene recovery unit, to be mounted in the grounds of Presidente Bernades refinery at Cubatao, has reached Santos. In August 1957 the plant should begin producing 8,000 tons annually; capacity to be raised to 18,000 when catalytic cracking is installed. Private enterprises have signed contracts with Petrobras to purchase the ethylene and manufacture styrene monomer, polyethylene, polystyrene, etc.

Brazil To Produce Synthetic Rubber

Brazil is considering the production of synthetic rubber. The shortage of Brazilian natural rubber will oblige the country to import 200,000 tons, costing US $150 million by 1960. On the other hand, an investment of $30 to $40 million, plus expenditure in cruzeiros, would install plant to produce 40,000 to 50,000 tons of synthetic rubber annually. The installation is dependent on construction of the refinery in the Federal District, which will insure essential supplies of raw material.

Union's Costa Rica Cocolas No. 3 Spudded

Union Oil Co. of California has plugged its Cocolas No. 2 well near the Costa Rican-Panama border, and has spudded in Cocolas No. 3 in the same immediate area. Cocolas No. 2 now shows encouraging signs of becoming a producer. Initially having produced 1,000 b/d of high-quality oil, further tests showed increasing salt water to a point where Union felt the well of no commercial value by itself.

Union also has closed down its operations in Panama. Drilling has ceased at Yorkin No. 1 well in Panama, close to the Costa Rican border at 5,500 ft. Officials report "good shows but no oil." The rig will be transferred to Guatemala, where Union jointly with others will test several formations.

Closing of Yorkin No. 1 ends all test drilling in the republic of Panama at this time. Caribbean International, which had been shallow-test-drilling in the remote Darien area near the Colombian border, halted operations before the first of the year, and future plans are indefinite. With considerable seismograph and geological exploration in Panama, it is expected several test wells will be drilled on various concessions.

Union will bring a second drilling rig to Costa Rica this year, to be used on an entirely different structure near the town of Limon. Limon, a seaport on the Caribbean, is capital of the state of Limon where Union holds extensive exploration and exploitation rights.

Mene Grande Revises Prices

Mene Grande Oil Co. has announced a revised price schedule for Venezuelan crude oil and condensate, fob loading terminals. There was no change in posting for Anaco wax crude oil, but the gravity differential for each 0.5 deg below 41.4 deg has been increased from 2 cents to 2.5 cents; 36.0 deg to 36.4 deg Oficina crude was reduced by 5 cents per barrel from $3.14 to $3.09; gravity differential increased to 2.5 cents for each 0.5 deg. Mesa crude in the 30.0 deg to 30.4 deg range was reduced by 8 cents per barrel to $2.79; on Leona crude in the 24.0 deg to 24.4 deg range the posting was reduced 5 cents per barrel to $2.49, with the gravity differential for each 0.5 deg reduced from 3 cents to 2.5 cents.

THE "SPYROS NIARCHOS" the largest

single-screw, single-purpose oil tanker in service, has recently completed her trials.

On an overall length of 757 feet she carries 47,000 tons deadweight and has a maximum power of 20,000 S.H.P. She is propelled by the largest, solid Novoston propeller of Heliston design yet manufactured. It is five-bladed and weighs 30½ tons.

Photograph by courtesy of the builders, Vickers-Armstrongs (Shipbuilders) Ltd.

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Oil Company Staff Changes

STEWART E. BARBER, presently on assignment with Shell Oil Co. of Canada Ltd., has been named assistant manager of auditing in Shell Oil Co.'s head offices in New York. He will assume his new duties July 1, 1957.

Since 1953, Mr. Barber has served as manager of refining and distribution accounting at Shell of Canada's Toronto office.

ROBERT B. DUMMETT has been appointed a director of British Petroleum Co. Ltd., to fill the vacancy caused by the resignation of B. R. Jackson. Since 1953 Mr. Dummett has been managing director of The Commonwealth Oil Refineries Ltd., BP's marketing organization in Australia.

D. Anderson, A. E. C. Drake, and C. E. Spearing have been appointed directors of BP Trading Ltd., BP's principal trading subsidiary.

P. T. Cox has been appointed managing director of BP Exploration Ltd.

H. W. TORGESON, staff assistant to W. T. Cravens, vice president and manager of refinery operations for Cities Service Oil Co., has been named manager of the company's Ponca City refinery. He succeeds S. R. McMurry, who has been transferred to Bartlesville headquarters.

L. G. Brannin, cracking foreman at the refinery, has been named assistant plant manager in charge of operations.

C. W. Rohler, chief process engineer, has been appointed assistant manager in charge of technical services.

M. E. Wooldridge, formerly plant superintendent at Ponca City has been transferred to Bartlesville as head of the refining division operations department.

H. T. ROSS has been named vice president—engineering, Linde Air Products Co., a division of Union Carbide and Carbon Corp., New York.

DR. GERHARD HERZOG has been named assistant general manager of the Research and Technical Dept., The Texas Co., New York.

J. D. DAVIS of Shreveport, has been appointed to the position of assistant to Ed Parkes, president of United Gas Pipe Line Co. and Union Producing Co., and executive vice president of United Gas Corp.

CHARLES F. RADLEY, one of the original directors of Oakite Products, Inc., has retired from active duty, but will continue as a consultant on advertising, public relations, and general management policy. Employed in 1917 as editor of *Oakite News Service*, Mr. Radley was elected a director in 1926. For the past 30 years he has been responsible for Oakite's advertising program.

JOSEPH T. FROEHLICH has been named superintendent of The Texas Co.'s new 40,000 b/d Puget Sounds Works, at Anacortes, Wash.

DR. JOHN E. KASCH has been elected a vice president and a member of the board of American Oil Co., New York.

S. G. SANDERSON has been elected vice president and John S. Sprowls assistant treasurer of Gulf Oil Corp. Mr. Sanderson is division manager of the company's Tulsa production division, and is responsible for Gulf's crude-oil production activities in Oklahoma, Kansas, Illinois, Michigan, Nebraska, and several adjacent states. Mr. Sprowls will be in charge of the newly created section of the Treasury Department—loans and related investments—and will have direct responsibility for financial negotiations relative to these activities.

P. L. ROBISON has been appointed manager of refinery at Port Arthur, Texas. He succeeds Robert Stewart, who is retiring after 46 years of service with the company. B. E. Milner has been named general superintendent at the refinery.

EARL W. UNRUH, formerly vice president of operations, Sinclair Pipe Line Co., has been elected president and chairman of the executive committee. He succeeds William H. Morris in both posts. Mr. Morris was recently elected vice president of Sinclair Oil Corp., of which the pipeline company is a subsidiary.

G. M. Johnson, formerly vice president in charge of crude-oil lines, succeeds Mr. Unruh as operations vice president, and in turn is succeeded by J. D. McConnell, formerly director of engineering.

C. M. Cotten, auditor, and C. F. McCoy, vice president, have been elected to the pipeline company's board of directors.

S. G. SANDERSON has been elected a vice president of Gulf Oil Corp. He has been division manager for the company's producing division in the Mid-Continent field since 1952. Mr. Sanderson joined Gulf in 1913 at its Kiefer, Okla., gasoline plant. He became general superintendent of the gasoline department in 1919 and general production superintendent in 1929.

ERNEST K. DODSON has been elected administrative vice president of Cosden Petroleum Corp., Big Spring, Texas. He formerly was in charge of the company's Midland land office.

J. RONALD GETTY has been elected a director of Tidewater Co. to fill the vacancy left by the death of Fero Williams.

For the past two years Mr. Getty has served as managing director of Veedol BmbH, Tidewater's marketing subsidiary in West Germany, with headquarters in Hamburg. In addition, he has been manager of the company's export activities in Europe, the Middle East, and Africa.

James A. Ahearn *Thomas B. Kimball* *Marc F. Braeckel*

MARC F. BRAECKEL and Thomas B. Kimball have been elected executive vice presidents of Sinclair Refining Co. Both were formerly vice presidents.

Mr. Braeckel will continue as director of marketing of the company, while Mr. Kimball will continue as director of manufacturing. James A. Ahearn, vice president and director of transportation, supply and distribution, has been elected executive assistant to James E. Dyer, president. Sinclair Refining Co. is the manufacturing and marketing subsidiary of Sinclair Oil Corp.

V. C. GEORGESCU, assistant coordinator of the worldwide producing activities of Standard Oil Co. (N. J.), has been appointed associate London-Middle East representative. He will serve on the staff of P. J. Anderson, recently appointed to the newly created position of London-Middle East representative.

BAXTER F. BALL has been named vice president and director of marketing, General Petroleum Corp. Ball succeeds John C. Sample, who is returning to Standard Vacuum Oil Co., in New York, as vice president and director.

P. L. ROBISON has been appointed manager of The Atlantic Refining Co.'s Port Arthur refinery. He succeeds Robert Steward, retiring after 46 years with the company. B. E. Milner has been named general superintendent at the refinery.

GEORGE L. WILLIAMS, of Attleboro, Mass., has been elected a director of B-I-F Industries. Treasurer, clerk, and director of Metals and Controls Corp., Mr. Williams is also a director of Attleboro Trust Co. Formerly business affiliations include General Electric and US Steel Corp.

J. H. RICE has been appointed manager of pipelines for The Ohio Oil Co. Ralph M. Slough, manager of pipeline electrical and communications department, becomes assistant manager.

Mr. Rice started with Ohio Oil in 1930 in the Yates field, West Texas. He worked as a laborer, truck driver, tractor operator, gauger, assistant foreman, and in 1942 was appointed assistant district superintendent at Yates. Transferred to Casper, Wyo., as assistant superintendent of the Wyoming Pipeline Division in 1945, he was named division superintendent in 1948 and assistant manager of the company's pipelines in 1954.

Mr. Slough has been in the oil business for 34 years, joining Ohio Oil in 1922. Since then he has been in several jobs with the company, including supervisory positions in pipeline, construction, and electrical work. He was made superintendent of building construction in 1935 and manager of communications in 1938.

Charles F. Radley

J. Ronald Getty

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IH "95" Payhauler, tough, fast, giant off-highway truck. 335 turbo-charged hp., 38 m.p.h., 24 tons.

Truck Trends

(Continued from page 49)

weight and length laws in the United States have brought a need for creative design which actually has sparked developmental work which has led to truck-design improvements now widely used in all industries and throughout the world. This one point, therefore, can lead to continued advance in truck design. Call on the skills and technical know-how of the truck manufacturers to help solve knotty problems of mobility, whether it be in exploration, oil-field, off-the-road, or marketing applications!

Another way the industry can help its more efficient is to establish truck mainown cause in the continual battle to be tenance as a business—not as an afterthought or necessary evil. Preventive maintenance is an often-used phrase which has not had the proper emphasis, particularly in an industry such as petroleum, where trucks are called on for the most rugged and demanding service. Maintenance planning is of definite value—and, here again, the manufacturers have developed systems to assist truck operators in getting maximum utilization, unit by unit, as well as for the entire vehicle. These systems are just as important in normal business operation as during periods of national emergency. Parts' availability is just one phase of this cooperative effort to keep trucks operating and downtime at a minimum. The manufacturers have developed modern, scientific systems to have the right parts at the right place and at the right time—again a matter of logistics.

This same analytical approach to the problem on the part of the truck user means fewer breakdowns and improved efficiency.

Keeping the petroleum industry on the move is a tremendous task—and the continuing growth of the industry sometimes makes it difficult to keep pace with, let alone improve and refine, truck transportation. However, the flexibility and the ability of the motor truck to adjust to changing conditions and to fit into new needs bring about a continually greater usefulness in the logistics of the petroleum industry—in its forward move. END

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Gasoline Plant Construction Corp.
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The Griscom-Russell Company
Grove Valve & Regulator Co.
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Rockwood Sprinkler Co.
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E. W. Saybolt and Company
A. O. Smith Corporation
Smithco Engineering, Inc.
Snyder Company, Inc.
Southern Engine & Pump Co.
Southwest Industries, Inc.
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Worthington Corp.
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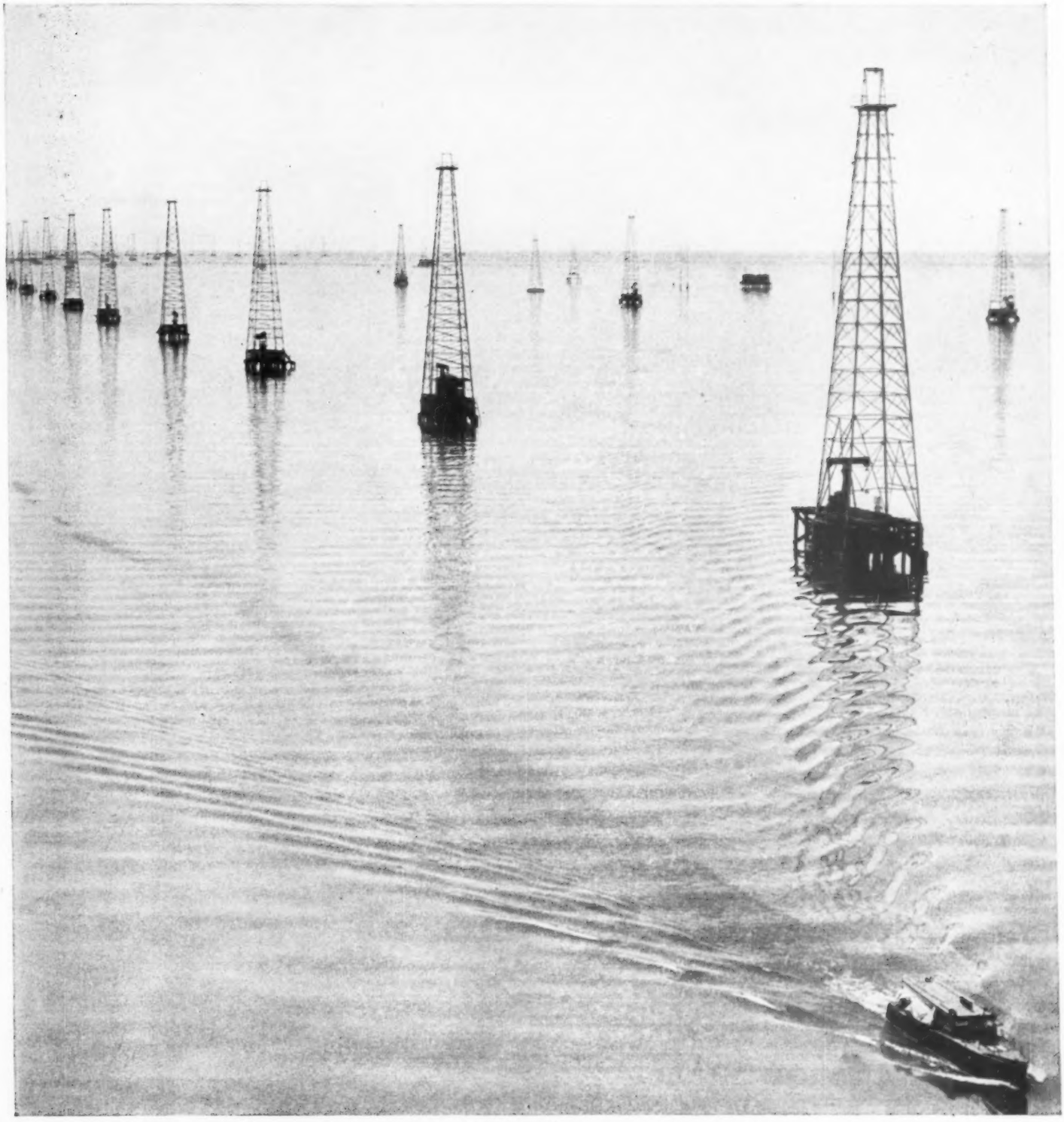

A vital need for an expanding world economy is that kind of integrity in governments which encourages confidence . . . governments that are consistent, reliable, and responsive, not only in their dealings with their own citizens, but in dealings with each other and with each other's citizens.

—Eugene Holman, Chairman of the Board, Standard Oil Company (New Jersey)

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New Publications

THE RESURGENT YEARS—HISTORY OF THE STANDARD OIL COMPANY NEW JERSEY, 1911-1927; by George Sweet Gibb and Evelyn H. Knowlton; cloth; 754 pages; halftones, tables, and charts; published by Harper & Bros., New York (1956); **$7.50. This is Volume II** of the 3-volume series on Jersey Standard, prepared under the auspices of the Business History Foundation Inc. Volume I—titled "Pioneering in Big Business," by Ralph and Muriel Hidy—is the chronicle of the early decades when Jersey Standard was primarily an American corporation. Volume II—beginning with the dissolution of the Standard Oil Trust in 1911 and ending with the year 1927—recounts the turbulent years of World War II and the postwar recession and boom. **Volume III, in** preparation, probably will carry forward to the present.

Volume II is the case history of how one particular company—"representing a type of enterprise Americans popularly call Big Business"—operated in a certain span of years. This was **a period which** saw a great boom in petroleum, the fueling of a world war and a burgeoning automotive industry, and the opening of great new oil fields at home and abroad. Most dramatically, it is the story of a great organization's venture on the international scene—marked by fierce competition at home and monopolies and cartels abroad, especially in Europe and the Far East. Though the authors' emphasis is upon administration and organization, it is also the story of young and dynamic men of vision—especially of one Walter C. Teagle—effecting at home the integration of the company's operations from oil field to service station, and winning abroad the fight for the open-door policy and an equal footing for Americans with the nationals of other countries in the world search for oil and markets. In this 1911-27 period, Jersey Standard threw off its shackles and became independent of other producers for its domestic crude supply; it increased its domestic production 14-fold and its refining facilities 3-fold; it acquired a great transportation network of pipelines and a fleet of oil tankers to ply the Seven Seas; and it embarked upon a global expansion unparalleled in business annals. Furthermore, it had to adapt its policies and procedures to new concepts in the field of government and public relations.

With respect to its expanding international policy, Walter Teagle announced in January of 1920 that "henceforth Jersey Standard intended to show an interest in every producing area in the world, no matter where situated." (Of course, this was not a new policy; the company had operated in the foreign field for many years on a restricted basis.) But by the middle of the same year 1920, E. J. Sadler, head of Jersey's Production Department, was able to report that "the company had already come close to fulfilling the promise of Teagle's January statement." Sadler "traced existing activities, or the desire for participation, in actual or potential producing properties in Mexico, Romania, Russia, Venezuela, Poland, Bolivia, Morocco, Algeria, Tunis, Madagascar, Spain, Iraq, Persia, Palestine, Argentina, Brazil, Alaska, Egypt, China, and the Dutch East Indies." "Jersey Standard was openly committed to the race for world petroleum supplies . . .and all phases of the company's foreign activities became implicated in the web of international political intrigue."

As with Volume I, the authors had free access to all Jersey Company files and records. Company officials reviewed the chapters and made suggestions; but the story is the authors' own—as they saw it. It is the story not only of a single company, but of an era. It is a monumental work—though perhaps a bit too detailed. For the executive or student with a yen to delve into the administrative ramifications—political and economic—of a great globe-girdling corporation in an era of unparalleled expansion, this volume should prove a fascinating adventure.

BIBLIOGRAPHY OF SOLID ADSORBENTS, 1943 TO 1953; by Victor R. Deitz; National *Bureau of Standards Circular 566*, March 1956; 1,528 pages; **$8.75 (foreign** countries, $11.67). (Order from the US Government Printing Office, Washington 25, D.C.). This annoted bibliographical survey of the scientific literature covers the period from 1942 to 1953, and contains approximately twice as many references as are found in the *Bibliography of Solid Adsorbents, 1900-1942*. A complete author index and a complete subject index are features of this circular. The utility of the subject indexing is contained in the main heading, which is based on the type of adsorbent, and the subheadings which cover some general aspects of the gas or solution phase.

SEDIMENTARY ROCKS, 2nd edition; by F. J. Pettijohn; considerably expanded over the original, comprising 718 pages. Price $12, it is available through Harper & Bros., New York (1957). The author is a member of the Department of Geology, at John Hopkins University. The volume is designed primarily as a textbook. It has considerable value for a geologic library, although it is designed for students and described as being on the elementary level.

GEOPHYSICAL CASE HISTORIES, Volume II (1956); edited by Paul L. Lyons (chief geophysicist, Sinclair Oil and Gas Co.); published by Socy. of Exploration Geophysicists, Box 1536, Tulsa 1, Okla.; price $6.00 to SEG members, $7.00 to others. The second volume contains information about 42 oil fields and 3 mines, as well as 5 papers on new applications of geophysics and 3 general papers. Some 46 companies supplied the information which was written by 75 authors. Twelve cases alone of the 43 reviewed demonstrate the oil-finding effectiveness of geophysics. It is estimated that 10 of these fields alone will produce more than a billion barrels of oil, the highest return coming from fields which have multiple pay zones indicated by geophysical prospects.

STRUCTURAL GEOLOGY, by L. U. de Sitter; cloth; 552 pages; published by McGraw-Hill Book Co., New York (1956); $11. By a professor of structural and applied geology at the University of Leiden (Holland), this volume is in a series in the geological sciences. The author draws on his wide experience in order to establish a link between the theory and practice of orogenesis. Physical properties of rocks are described; comparative structural geology is covered, proceeding from simple to more complex structures; and the characteristics of the largest structural units are defined and theories about their origin are discussed. Thus theory, experiment, and actual cases are correlated.

Industry Brochures

BULLETIN TR-544: "HIGH-TEMPERATURE PROBLEMS IN PROCESS PLANTS" (1956) by John B. Rutherford; 8-page brochure by Babcock & Wilcox Tubular Products Division, Beaver Falls, Pa., which discusses use of steel and alloys, mechanical and physical reactions of materials under temperature and corrosive environments. Free on request to Babcock & Wilcox.

ENGINEERS AND CONSTRUCTORS FOR INDUSTRY THROUGHOUT THE WORLD, 20-page illustrated brochure by The Lummus Co., 385 Madison Ave., New York (1957), describes services and facilities of Lummus for the process industries of the world.

FLUID COKING—A CONTINUOUS COKING PROCESS (1957), a 12-page illustrated brochure by Esso Research & Engineering Co., 15 West 50th St., New York 19.

INCREASED RELIABILITY OF INDUSTRIAL DATA SYSTEM (Reprint R-98, 1957), a pamphlet by Beckman Instruments Inc., Fullerton, Calif., which traces development and future role of closed-loop automation systems.

CONSOLIDATED-PHILLIPS TYPE 38-401 ULTRAVIOLET OXYGEN ANALYZER (1956) describes, for process-plant use, a colorimetric differential-photometer method for continuous detection and accurate measurements of trace amounts of oxygen in gas streams; obtainable from Consolidated Electrodynamics Corp., 300 N. Sierra Madre Villa, Pasadena, Calif.

SOLVENT DECARBONIZING, 16-page illustrated brochure (1957), describes a "paracritical" liquid-liquid extraction process, developed to supplement vacuum distillation and recover a substantially higher percentage of profitable catalytic feed from residues which would otherwise go to fuel or to thermal cracking; published by M. W. Kellogg Co., 711 Third Ave., New York 17, N.Y.

TECHNICAL INFORMATION ON THE FLUORESCENT PROPERTIES OF EMULSION DRILLING MUDS—"Fluorescent Interpretation," published by Oil Base Inc., 120 Oris St., Compton, Calif. This brochure describes a system to assure accuracy of long-wave ultraviolet analysis, to prevent misinterpretation of fluorescent "show" in cores and cuttings.

THE INDUSTRY NOBODY REALLY KNOWS, by Craig Thompson, for Gulf Oil Corp. Available through Gulf Oil Corp., this 32-page booklet is aimed at giving consumers of all petroleum products a more realistic understanding of how the oil industry actually gets its job done. The story is told in terms of the individual experiences of independent operators who have only a contractual relationship with any major oil company. The publication separates fact from myth in explaining how oil men, who comprise "the largest industrial enterprise ever known," carry on their business.

INDEX OF LITERATURE, by Minneapolis Honeywell Regulator Co. A bulletin listing information sources by Minneapolis Honeywell and others on industrial and valve division literature, and instrumentation; *Bulletin G-2*. Available from the company's branch offices.

MARINE VALVE CATALOG; 32-page Edward Marine Catalog 256, which features all the latest Rockwell-built Edward steel valves for a wide variety of marine applications. **For handy reference,** this booklet contains certain applicable excerpts from the *US Coast Guard Marine Engineering Regulations*. Available from Edward Valves Inc., East Chicago, Ind. (subsidiary of Rockwell Manufacturing Co.).

Reports and Surveys

THE WORLD'S TANKERS, by Laurence Dunn; 175 pages; published by Adlard Coles Ltd., with George C. Harrap and Co. Ltd., and John de Graff Inc., New York (1956); $6.95. Indexed, this is an illustrated history and description of the development of the world's tanker fleet.

ANALYSIS OF WORLD TANKSHIP FLEET, December 31, 1955: By Sun Oil Co. Statistical Research Dept., Philadelphia, Pa. A complete review of the world's tanker fleet, giving analysis and statistical tabulations.

SUEZ CANAL COMPANY—STOCKHOLDERS' MEETING OF JUNE 12, 1956: (in French); Report of company's management covering 1955 operations of the canal.

TANKER HANDBOOK FOR DECK OFFICERS, by Captain C. Baptist: An operational book of about 124 pages; published by Brown, Son, and Ferguson Ltd.; 52-58 Darnley St., Glasgow S.1, SCOTLAND; price 18s 6 d (about $2.60).

FLOW OF NATURAL GAS THROUGH EXPERIMENTAL PIPE LINES AND TRANSMISSION LINES, by R. V. Smith, J. S. Miller and J. W. Ferguson. Monograph 9 of the Bureau of Mines. 89 pages.

PERSIAN OIL, by L. P. Elwell-Sutton. The history of the Iranian oil industry from the Iranian viewpoint and based on Iranian documents. Price 25 shillings. Available through Lawrence & Wishart, Ltd., London, England. 343 pages.

BOLIVIA—ANNUAL REPORT OF YPFB: The annual report of Yacimientos Petroliferos Fiscales Bolivianos for 1955. Covers the company's operations from exploration through sales. Since YPFB is the only producing company in Bolivia at present, the figures are useful on a national basis. Available from the company in La Paz.

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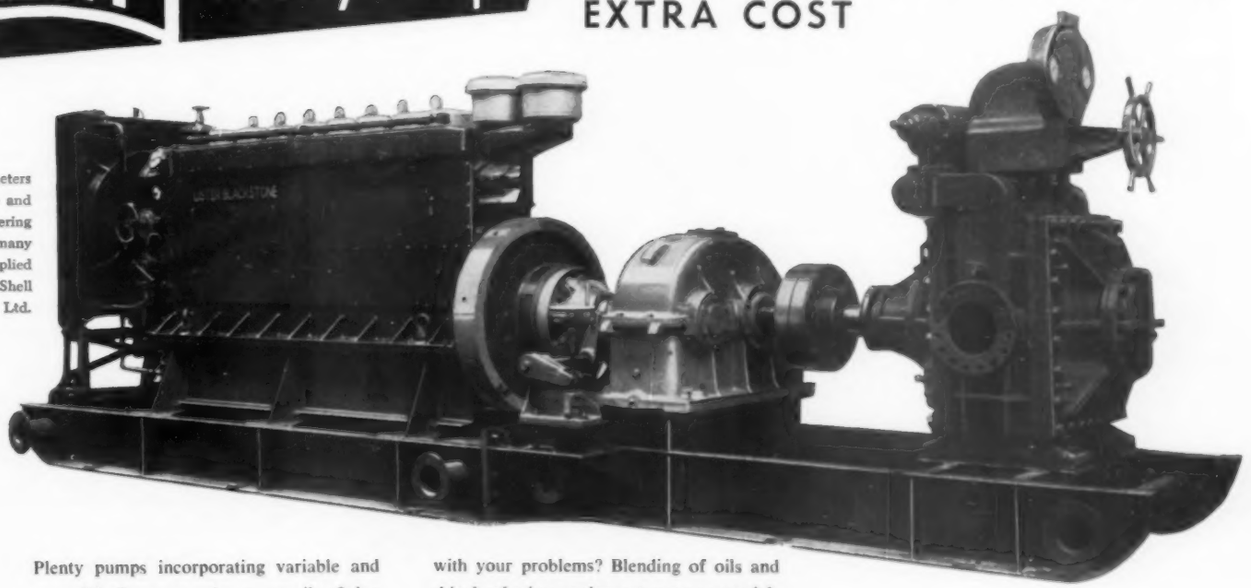

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Dresser's Backlog Continues to Rise

Dresser Industries Inc., Dallas, a leading manufacturer of oil, gas, chemical, and electronic equipment, announced in a statement by chairman H. N. Mallon that the company's backlog of unfilled orders amounted to $84,812,000, an increase of 21% over the backlog as of the end of the prior quarter, and an increase of 46% over the comparable period a year ago.

Mr. Mallon noted that Dresser recently acquired the Hermetic Seal Transformer Co. Inc., of Garland, Texas, a small but rapidly growing manufacturer of electronic equipment—primarily iron core components such as transformers, filters, reactors, amplifiers, and other products used in the manufacture of communications equipment, computers, control systems, and radar and sonar devices. Hermetic will be a subsidiary of Southwestern Industrial Electronics Co., another Dresser company acquired in early 1956.

Oil Professors Wanted

Instructors are wanted by the Graduate School of Southwestern Louisiana Institute, as indicated in the following announcement:

"Graduate Petroleum Engineers needed to fill permanent position on Petroleum Engineering Faculty at Southwestern Louisiana Institute, in Lafayette, Louisiana. M.S. or Ph.D. preferred, but will consider candidate for these degrees. Salary and rank depend on education and experience. Write G. G. Varvaro, Head Department of Petroleum Engineering, S.L.I., Lafayette, Louisiana."

Texas Di-Isobutylene Facilities

The Texas Co. has completed facilities at Port Arthur, Texas, for production of di-isobutylene, used in the manufacture of plastics, elastomers, additives, and other chemical products. Initial capacity will be 8,000,000 lb annually.

New South American Relief Map

A plastic relief map of South America has been published by Aero Service Corp., 210 E. Courtland St., Philadelphia. The realistic, three-dimensional map is printed in 10 colors, ranging from copper-brown to dark green, dimensions are 41 by 54 inches. Seven land elevations and four ocean depths are shown. Scale is one inch equals 110 miles. Vertical exaggeration, common to all relief maps to emphasize land forms, is 20 to one. The map extends south from Miami, Florida, to areas below Cape Horn and includes Central America and the Caribbean. It depicts the Galapagos Islands on the west and the Brazilian islands, Fernando de Noronha, on the east. The Andes, difficult to visualize on conventional flat maps, are portrayed in striking relief; one point, Mt. Cerro Aconcagua in the Argentine Andes, has a height of 23,075 feet, and its peak rises a full inch above the relief map's lowest point.

Plastics Laboratories Opened

Polymer Chemicals Division of W. R. Grace & Co. has opened new research and customer application laboratories at Clifton, N. J. The laboratories will supplement work done at the new petrochemical plant now under construction at Baton Rouge, La.

At Baton Rouge the company will obtain gases from Standard Oil Co.'s refinery for the production of polyethylene resins. Capacity of the plant is to be 50 million pounds yearly. Phillips Petroleum Co. low-temperature process is to be employed.

At Clifton researchers will work on new processes and new products in the plastics fields as well as to aid customers in using polyethene resins. Injection molding equipment has been installed for this purpose as well as testing equipment on which resistance to abrasion, heat, and chemicals may be measured.

New Vickers Appointments

Vickers Ltd., London, has announced the following additions to the board:

E. O. Faulkner, a managing director of Glyn Mills & Co.! deputy chairman of Union Discount Co. of London Ltd.; a director of Hudson's Bay Co. and of Richard Thomas and Baldwins Ltd.

G. H. Houlden, a director of Vickers-Armstrongs Ltd., and managing director of Vickers-Armstrongs (Shipbuilders) Ltd.

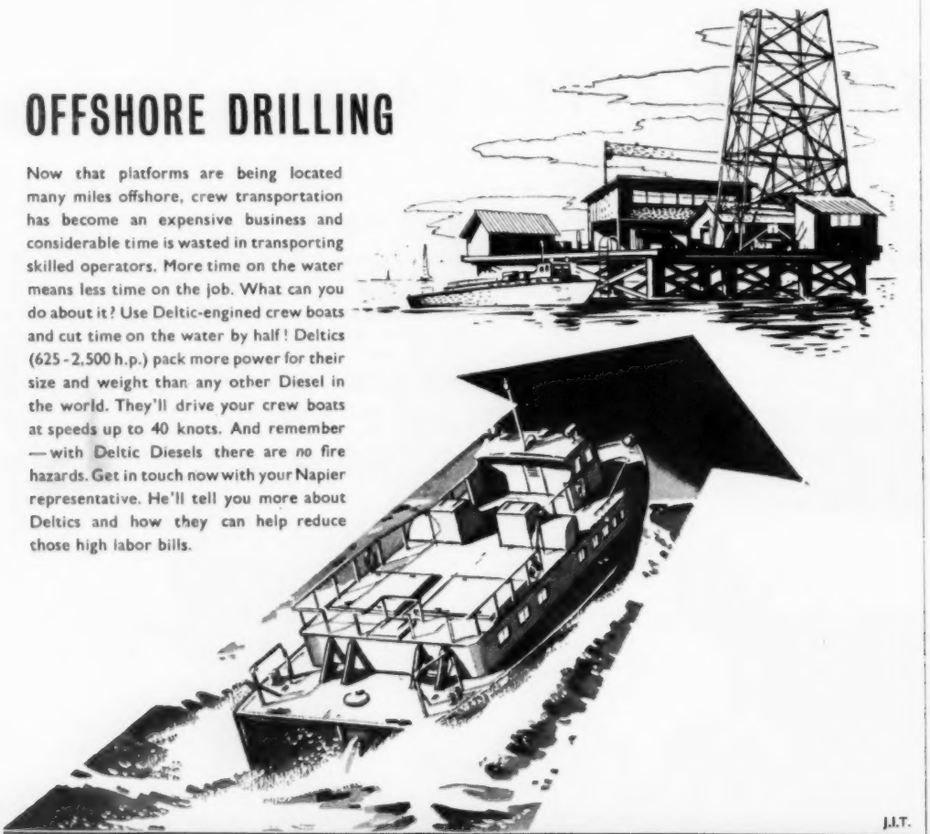
New Badger Director

C. Dana McCoy, former international director and New York manager of the Rust Engineering Co., has been appointed international director of Badger Manufacturing Co. of Cambridge, Mass. He will make his headquarters in Badger's New York office at 60 East 42nd Street, devoting himself largely to the company's rapidly expanding international business of design, engineering, and construction of petroleum refineries, petrochemical, pharmaceutical, chemical and other processing plants.

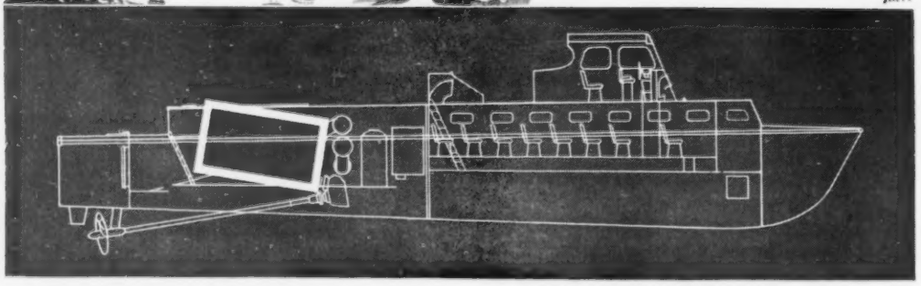
Mr. McCoy brings to Badger over 30 years of engineering. Prior to his Rust Engineering tenure, he was affiliated with Foster Wheeler Corp.

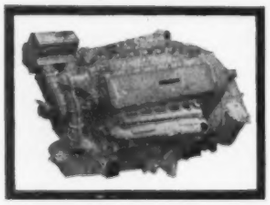
OFFSHORE DRILLING

Now that platforms are being located many miles offshore, crew transportation has become an expensive business and considerable time is wasted in transporting skilled operators. More time on the water means less time on the job. What can you do about it? Use Deltic-engined crew boats and cut time on the water by half! Deltics (625-2,500 h.p.) pack more power for their size and weight than any other Diesel in the world. They'll drive your crew boats at speeds up to 40 knots. And remember—with Deltic Diesels there are *no* fire hazards. Get in touch now with your Napier representative. He'll tell you more about Deltics and how they can help reduce those high labor bills.



J.I.T.





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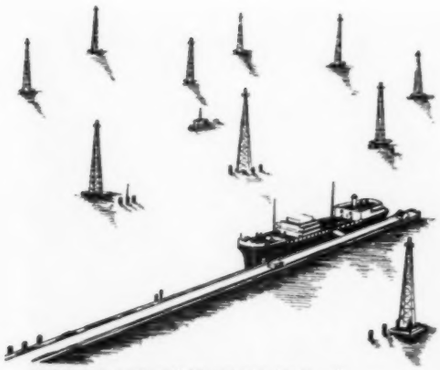

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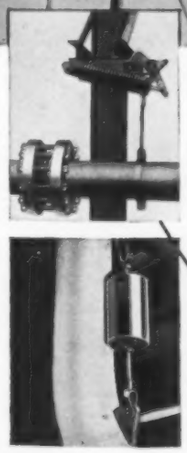
Photograph by courtesy of The Associated Ethyl Company Limited.

VOKES GENSPRING pipe hangers are used throughout the oil industry

At their Ellesmere Port Works in Cheshire, The Associated Ethyl Company Limited have made use of VOKES GENSPRING Variable Support Pipe Hangers to control movement which could set up very great stresses in the piping. 'Shell' have also incorporated VOKES GENSPRING hangers throughout the Platforming Unit at their Stanlow Refinery in Cheshire.

Photograph by courtesy of 'Shell'.



VOKES GENSPRING Variable Support Hangers are specifically designed for the control of vibration and limited thermal movement of piping, but where piping systems need to be 'floated' to offset the effects of extensive movement, Vokes Genspring Constant Support Hangers should be used. The full range is detailed in the Vokes Genspring catalogues available on request.

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Lumpkin is Appointed to Girdler Catalyst Staff

W. DOSS LUMPKIN has joined the catalyst department of The Girdler Co., Louisville, Ky., to specialize in the marketing of catalysts employed in the processing of fats and oils, and in the hydrosulfurization and treating of petroleum feed stocks.

Licenses British Lube Firm

Jet-Lube, Inc., Burbank, Calif., has granted a manufacturing license to A.B.C. Coupler & Engineering Co., Ltd. of London, England, for the manufacture of Jet-Lube's tool-joint and pipe-thread compounds and its extreme-service greases and oils. The new English company will manufacture the entire line to the same specifications as the American products. The company now has manufacturing affiliates in Canada and Australia.

Financing Arranged for British Petroleum Tankers

Financing of £40 million ($112 million) worth of new oil tankers for BP Tanker Co., shipping subsidiary of The British Petroleum Co. Ltd., has been arranged through Robert Fleming & Co., Ltd., a leading London investment firm, it was announced, February 28. The financing is subject to Treasury approval.

A new company, Tanker Charter Co. Ltd., jointly owned by Robert Fleming & Co. and Ship Mortgage Finance Co., will raise £40 million, using tankers being built to the order of BP Tanker Co. as security. These tankers will be chartered to BP Tanker Co. on terms calculated to cover the loan interest and retirement over 23 years, at the end of which period the tankers will revert to BP Tanker Co.

A syndicate of banks headed by National Provincial Bank have agreed to advance £15 million, and two medium-term stock issues totaling £25 million have been placed with institutional investors.

R. B. Dunnett

New BP Director

R. B. Dunnett has been appointed a director of British Petroleum Co. Ltd., to fill the vacancy caused by the resignation of Basil R. Jackson.

D. Anderson, A. G. C. Drake and C. E. Spearing were appointed directors of BP Trading Ltd., as of February 14.

Walter Levy Reviews International Oil Policy

The general outlines of an international oil policy designed to protect "our essential interests and those of our Allies in the Middle East" have been proposed by Walter J. Levy, oil consultant who was formerly advisor to the State Department and E.C.A., now consultant to several leading oil companies.

Writing in the spring issue of *Foreign Affairs*, he asserts that "the United States must proceed simultaneously along three lines:

"(1) Emphasize the community of interest between Middle East states and the West, and minimize thereby the opportunities for Soviet intrigue.

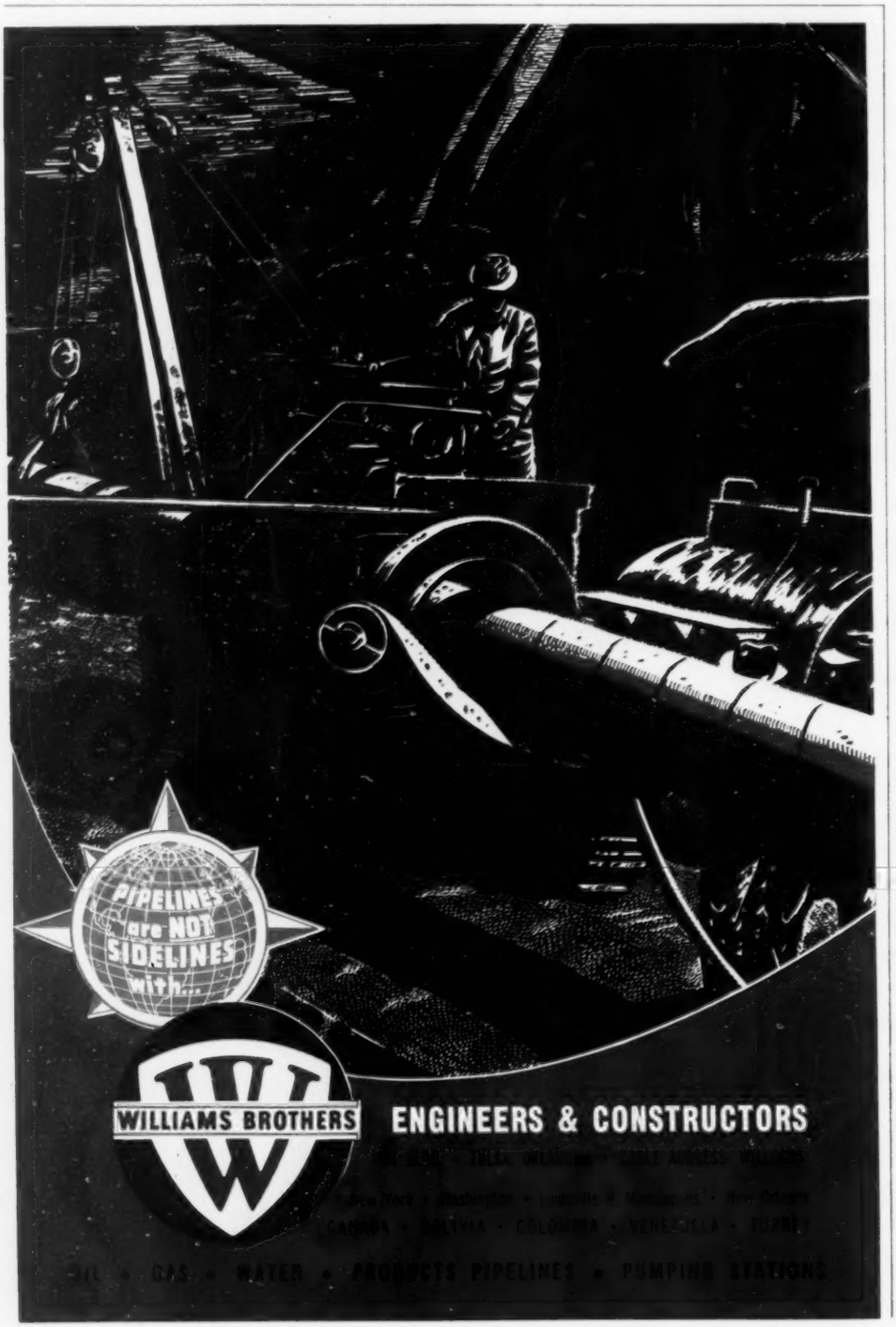
"(2) Minimize Western vulnerability to the interruption of the flow of Middle East oil, and increase thereby the bargaining position of the West.

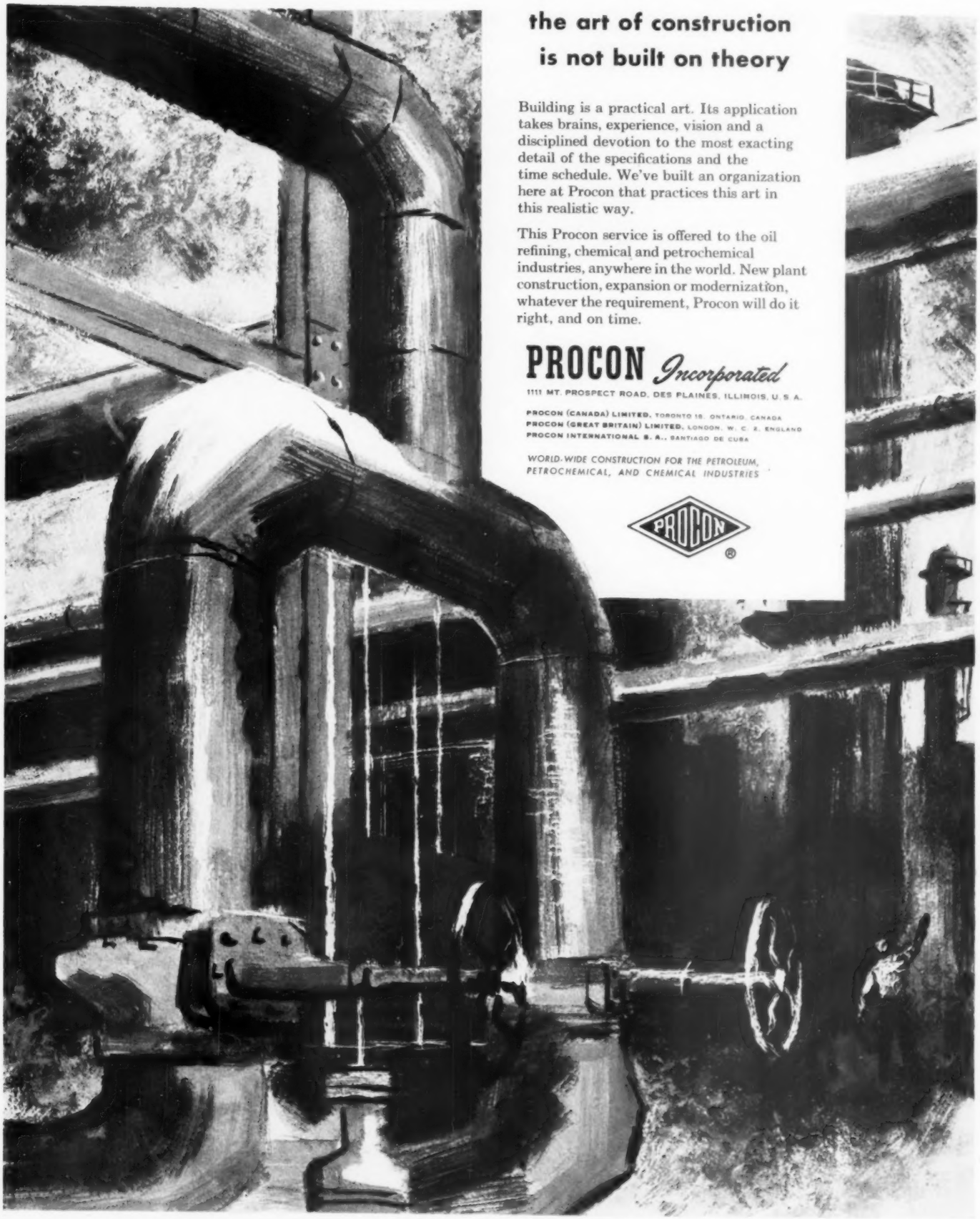
"(3) Support effectively the rights of private companies which are prerequisites to continued investment and development."

To achieve a position in which the West can cope at least with a temporary interruption of supplies, Mr. Levy proposes that substantial reserves—on the order of nine to twelve months of Europe's crude oil requirements—be accumulated in the consumer countries. Other suggested measures for reducing dependence on the Arab states are to develop excess productive capacity in the Western Hemisphere, Middle East and elsewhere, to increase refining facilities in the consuming countries and to achieve greater flexibility in transportation, primarily through the construction of additional tankers.

As a result of the deterioration of the West's bargaining position, "the commercial dominion of the international oil companies has been increasingly impaired," Mr. Levy asserts. "The threat of expropriation is ever present. . . . Under that threat, terms of concessions are constantly revised in favor of the Arab governments; and one revision is scarcely completed before new demands are presented. What appears to be minor impositions gradually add up to pretty basic changes in the circumstances under which companies operate."

An effective international oil policy, Mr. Levy states, will "involve some identification of the Western world with at least the most essential aims of Arab national aspirations—the development of their economies and improvement of standard of living." But, he concludes, "We must state unequivocally . . . our intention to assure Western access to Middle East oil and our readiness to protect the equitable rights and basic position of our companies. If our interests can in due course be fortified by treaties so much the better; if not, we must nevertheless undertake to support them with all the power at our command. They involve basic issues of international comity and behavior and our prosperity and security depend on the respect they command."





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Since 1939 Mr. Lemcke has represented the firm in exports, and has served in South America, Europe, and the Middle East. With the firm since 1951, Mr. Orton has spent all of his time in northern South America.

EDWARD GERSTENSCHLAGER has been appointed manager of production engineering of The Babcock & Wilcox Co.'s Boiler Division. His headquarters will be at the company's Barberton, O., Works.

ELWOOD KISBY has been named president of the Michigan-Ohio Pipeline Corp. He succeeds Charles A. Schrader, who resigned to become vice president of supply and transportation at Leonard Refineries Inc.

HAROLD R. PRESCOTT has been appointed assistant manager of the foreign department of Continental Oil Co., Houston. He formerly was manager of the geophysical section of the exploration department. He has been with Continental since 1928.

B. G. Swan has been named to succeed Mr. Prescott. Mr. Swan joined Conoco in 1932, and became assistant manager of the geophysical section in 1951; later was made central regional exploration manager. He is succeeded in that post by B. B. Colley, who is transferring from Houston.

R. P. MEDLIN has been appointed a chief process engineer, a post in the technical department of Magnolia Petroleum Co.'s Beaumont refinery. He replaces B. J. Schulz, who has become coordinator of lubricants and allied products on the headquarters staff of Socony Mobil Oil Co. Inc. laboratories in New York. E. J. Reeves, assistant chief process engineer in Magnolia's technical department plant testing section, has been shifted to Mr. Medlin's previous job of planning and coordinating assistant chief process engineer. R. A. Bowden, formerly an assistant chief process engineer in the plant's process control laboratory, has replaced Mr. Reeves.

WILLIAM C. BROWNING has been appointed research director of Milwhite Mud Sales Co.'s laboratories in Houston, Texas. He will head up all phases of the drilling-mud company's research and development. He has had many years' experience in the field of drilling fluids; and several patents connected with synthetic rubber, dispersing agents, and drilling compounds have been issued in his name.

WALTER DANNENBAUM was elected a member of the board of The Atlantic Refining Co., Philadelphia—effective April 1—to fill the unexpired term of N. S. McCausland, who resigned March 31. Mr. Dannebaum for many years has been affiliated with DuPont, of which he has been vice president since 1948, member of the executive committee, and a director.

L. E. INGHAM, after 46 years in natural gas, has retired as vice president of Texas Gas Transmission Corp. He will continue on the company's board.

E. M. HANSEN has been appointed manager of the petroleum equipment division of Axelson Manufacturing Co., Los Angeles, Calif., a division of US Industries Inc.

ROY J. DIWOKY, widely known executive with more than 20 years' service in the oil industry, has been employed by Commonwealth Oil Refining Co. Inc., Boston, Mass., and will be proposed for election to the board. On board approval, it is planned to elect him president.

Vander V. Gunn

VANDER V. GUNN, manager of South American subsidiaries for Halliburton Oil Well Cementing Co., is moving from the parent company's headquarters at Duncan, Okla., to Maracaibo, Venezuela. Mr. Gunn managed the Venezuelan subsidiary, Cia. Halliburton de Cementacion y Fomento, during 1947-1955, and has since been at Duncan. He spent 10 years with Shell's Mexican subsidiary before joining Halliburton in 1938.

GRAHAM B. MOODY of Berkeley, Calif., will become 41st president of the American Assn. of Petroleum Geologists on April 4.

HARVEY CASH has been elected to the board of Seaboard Oil Co., Dallas, Texas—replacing R. F. Baker, resigned. Mr. Cash is assistant to the board chairman of The Texas Co.

VON RHEA FRIERSON, former employee of the Sahara Petroleum Co. in Egypt, has joined the geology staff of the Oasis Oil Co. of Libya, a subsidiary of The Ohio Oil Co. Headquarters for Oasis of Libya are in Tripoli and Benghazi. The company is charged with operation of Libyan concessions totaling some 35 million acres owned jointly in undivided one-third interests by Ohio Oil, Continental, and Amerada.

William G. Copeland

Douglas P. Bailey

WILLIAM G. COPELAND has been appointed general manager of The Texas Co.'s refining department to succeed Theodore A. Mangelsdorf, who recently was elected a vice president. Douglas P. Bailey, assistant works manager of the company's Port Arthur, refinery since 1945, succeeds Mr. Copeland as manager of operations in the New York office.

Mr. Copeland joined Texaco in 1927 as a chemist at Port Arthur. He has served as assistant superintendent of the company's Lawrenceville, Ill., works and as superintendent of the Sunburst, Mont., and the Westville, N. J., refineries and general superintendent of the Port Arthur works.

Mr. Bailey also joined Texaco as a chemical engineer at Port Arthur in 1927. He served as assistant superintendent of the West Tulsa, works and was superintendent of the refinery of a Texaco subsidiary near Bordeaux, France, from 1934 to 1940.

He served in Washington with the Office of Petroleum Coordinator and Petroleum Administration for War from 1941 to 1943, when he returned to Texaco as general superintendent at Port Arthur. He was named assistant works manager at Port Arthur in 1945.

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NEW BRUNSWICK
British American Oil Co. Ltd.
Canadian Petrofina Ltd.

NEWFOUNDLAND
Foundation-Maritime Ltd.
Shell Oil Co. of Canada Ltd.

NORTH WEST TERRITORIES
Foundation Co. of Canada, Ltd.
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illustrated at right is field assembled water softener installed at British American Oil Company Limited, Clarkson, Ontario

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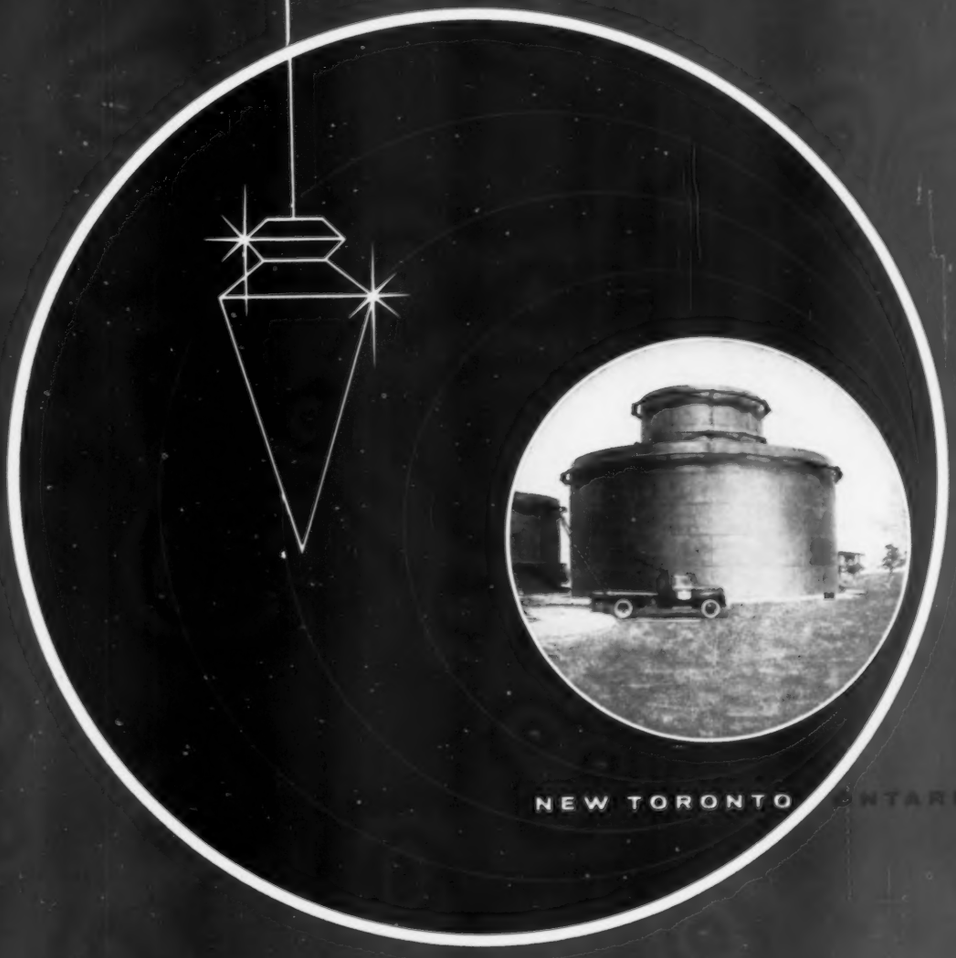

NEW TORONTO ONTARIO, CANADA

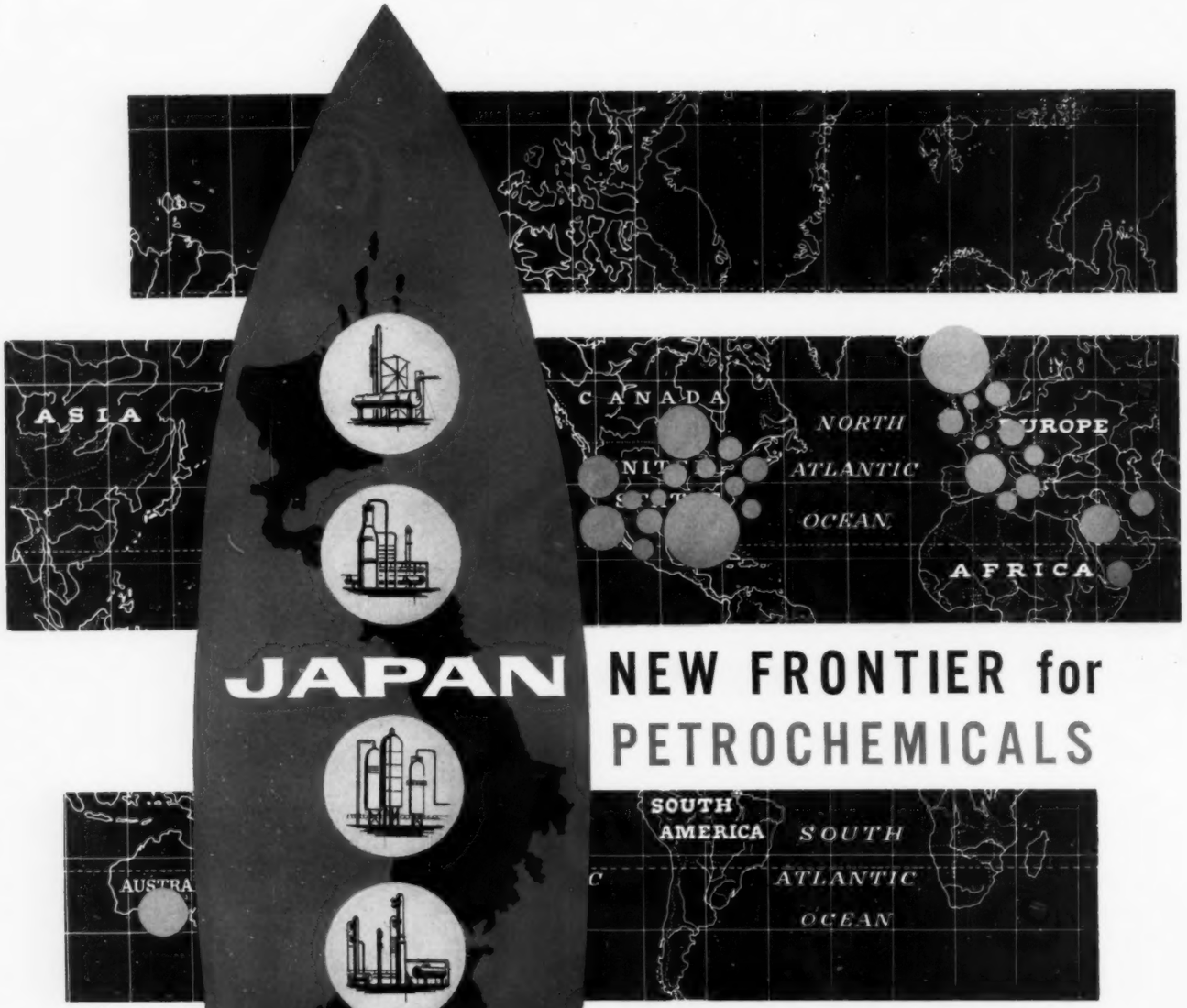

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Fig. 2652
Gaso 12" stroke pump mounted on skids.

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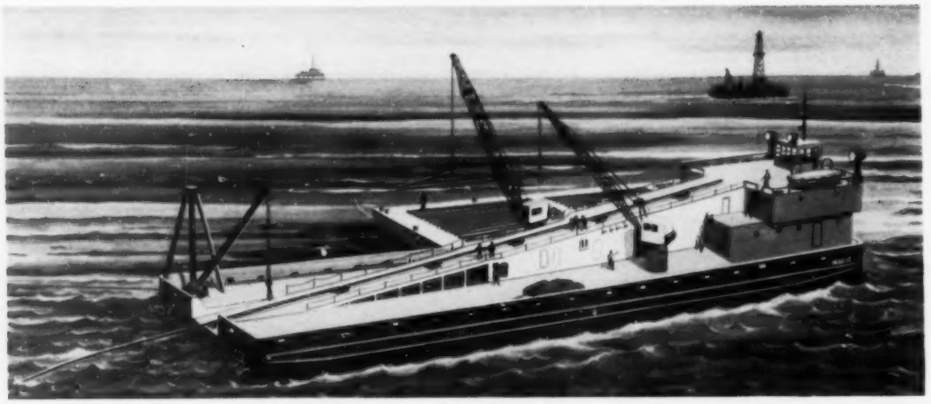

Artist's sketch of Marine Gathering Co.'s offshore pipeline-laying barge, the "Magic".

New Pipe-Laying Barge

Commonwealth Oil Co. recently inaugurated its new marine pipe-laying barge, the "Magic." The ultra-modern craft, with specially designed equipment and luxurious airconditioned quarters, is the first vessel specifically designed and built for laying pipeliens beneath the Gulf of Mexico. Specifications for the "Magic" were drawn by Robert C. Ledford, vice president of Marine Gathering Co., a wholly owned subsidiary of Commonwealth, which will operate the barge.

A tug will tow the "Magic" to each project, either at the shore end of the pipeline or at the producing platform offshore. Mounted on the barge is a ramp running the full length of the vessel, on which all of the various joint-welding and waterproofing operations take place. On each side of the ramp is a 35-ton crane for lifting pipe sections into place. Under the ramp are the equipment rooms.

From the bridge, the "Magic's" captain will pull the vessel along in a "bootstrap" operation by means of anchors at each of the four corners of the barge and special winches to operate the anchor cables. A tug will drop the barge anchors well in front of and behind the pipe-laying vessel. Then, by pulling in on the forward anchors and letting out on the aft ones, the captain will move the barge forward. The tug will operate around the barge continually, repositioning the anchors. With two anchors at each corner and only one being moved at each corner and only one being moved at a time, the barge will be held firmly in position at all times.

A ballasting system in the 13 1/2-ft-high hull will permit the barge to draw as little as 4 ft of water near the shore and as much as 8 ft in deep water, where the additional draft will contribute to stability.

The barge is capable of laying 2,000 ft of large-diameter pipe or 5,000 ft of small-diameter pipe during each 24-hour period, taking bad weather and routine mechanical shut downs into account.

Italian Tanker-Building Yard

Especially for large tankers, Cantere Navale San Benedetto expects to build new shipyard at Panigaglia in La Spezia Bay. Under way are plans for 25 vessels whose first keel is to be laid this fall.

Honor Reservoir Engineer Reistle

"Carl Reistle Night" was held in February in Houston to honor a distinguished reservoir engineer, Carl E. Reistle, Jr., vice president for production of Humble Oil & Refining Co. Occasion was a meeting of the Gulf Coast section, largest AIME section in the world, of which Mr. Reistle has been 1956 president.

With near chaos attendent upon the discovery of the East Texas field in 1931, overproduction, and 10-cent oil, Mr. Reistle (a former Bureau of Mines engineer) was assigned to the job, and began an attempt to measure reservoir pressures in the field and to organize them on a systematic basis.

When the East Texas Engineering Assn. was formed by operators in the field in 1933 to further this work, Mr. Reistle was invited to become its first field chairman. The cooperative effort which followed, in which he played a leading part, led to the launching of a water-injection program in the field in 1942. The end product will be a tremendous increase in the recovery of oil from East Texas.

Mr. Reistle joined Humble Oil & Refining Co. in 1936 as engineer in charge of its petroleum engineering division. He rose to head of the petroleum engineering division in 1940, to manager of production in 1945, and to vice president in 1955.

Tanker News

Esso Petroleum Co. Ltd., London, has ordered two tankers, each of 45,000 dwt, from Nederlandsche Dok en Scheepsbour Maj., Amsterdan.

Kokums Mek Verkstad, of Malmo, Sweden, announces delivery to owners Rederi A/S Ruth v/Hagbart, of Oslo, of the 19,460 dwt tanker "Raila" on January 15. Chartered by Shell Petroleum, London, tanker left Malmo the same day for Persian Gulf.

New Motor-Oil Additive

A motor-oil additive for the control of low-temperature sludge is being introduced for sale in cans to the consumer at the service-station level by E. I. du Pont de Nemours & Co. Pilot sales campaigns have been conducted in special test areas, and nationwide distribution is now under way.

The new additive is being sold under the trade name "M.O.A." as part of the du Pont No. 7 Line. It is packaged in 15-oz cans which retail at $1.50. Recommendations are that a can be added to the crankcase with each oil change. The additive is compatible with other refinery-blended additives, and is intended to compete with the "gyp" additives now being widely sold which analysis shows to be of little or no value.

Du Pont designed the additive particularly for stop-and-go driving. It is stated to be effective as a dispersant in the presence of water in the crankcase. A fleet of taxicabs was tested over an average of 50,000 miles per unit under severe sludging conditions with M.O.A., after which engines were found to be clean and only slightly worn.

Du Pont describes the new additive as being a nitrogen-containing polymer (lauryl methacrylate-dimethylaminoethyl methacrylate). It does not meet MIL specification for heavy-duty high-temperature oils of the diesel type, but is highly satisfactory for automotive use.

Several oil refiners are blending the additive in premium-grade wide-viscosity oils, the M.O.A. being added at the refinery.

Gas-Turbine Experiment

The US Maritime Commission has been conducting an experiment in "Liberty" ship propulsion by gas turbine. Preliminary results indicate greatly increased sailing speed and reduced fuel consumption as compared with the original steam reciprocating engines.

Speed on a stormy crossing of the Atlantic rose to 16.81 knots from 10 knots. Fuel consumption was 236 b/d operating on light fuel. Later runs are to be made on bunker "C."

W. Samuel Carpenter

New Du Pont Appointment

W. Samuel Carpenter, 3rd, has been appointed director of sales of Du Pont's Petroleum Chemicals Division, succeeding David H. Conklin, who becomes managing director of the Du Pont Co. (United Kingdom) Ltd. The appointments are effective April 1.

New Copco Division

A new division to sell and service Atlas Copco AB's stationary air compressors in the eastern United States has been established.

Operations of the new division will be directed from Atlas Copco Eastern Inc.'s general offices in Paterson, N.J.

New Petroleum Society

The American Institute of Mining, Metallurgical, and Petroleum Engineers has reorganized into the Metallurgical Society of AIME, the Society of Mining Engineers of AIME and the Society of Petroleum Engineers of AIME. Each society, in rotation, is to name the AIME president for one year. Each society each year is to elect two directors of the institute for three years. Each society each year is to designate two of its seven institute directors to serve as institute vice presidents for one year.

The Society of Petroleum Engineers of AIME begins with the following in office: President, John P. Hammond, Amerada Petroleum Co., Tulsa; vice presidents, George R. Gray, Baroid Division, National Lead Co., Houston; and Earl M. Kipp, The California Co., New Orleans.

Chapman Joins Aero

Aero Service Corp. has elected Alexander H. Chapman a director. Mr. Chapman is a consulting engineer, with offices in New York. He was a Washington representative for Arabian American Oil Co. until his retirement in 1956. Previously he was a partner of Hoover, Curtice & Ruby, concerned with foreign exploration and production operations. He has an extensive engineering experience with the oil industry, gained in many areas of the world over the past 33 years.

Alexander H. Chapman

Superlon a multi-service GLAND PACKING with a pedigree

SUPERLON is a high quality multi-service gland packing. Within the temperature range minus 40° F. up to 500° F. it is suitable for most services handling water, steam, solvents and oils, and chemicals and acids in moderate strengths and concentrations.

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The formula of SUPERLON was evolved as a result of our experience as specialist manufacturers of gland packings, and our pioneer work in processing Fluon, the new chemically inert plastic. No metallic elements or graphite are used in the manufacture of this gland packing.

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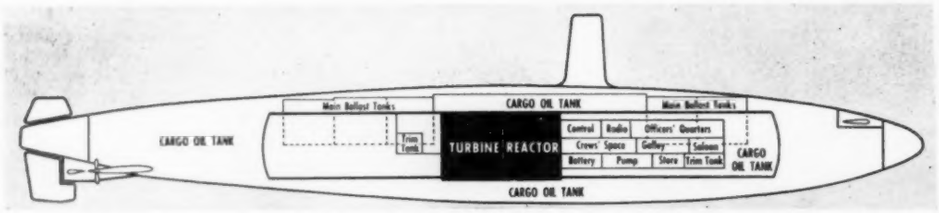


Submarine Oil Tanker

Mitsubishi Heavy Industries Ltd. has designed a 30,000 dwt atom-powered submarine oil tanker, on which about $800,000 has been spent for models and tests at Mitsubishi's yards in Kobe. Blueprints are being drawn up at present, and the company reportedly believes it could build the ship in two

The atomic propulsion units are in the center, with about 20,000 hp each. Overall length would be about 590 ft, inner-hull length 328 ft, displacement 44, 050 tons. Maximum speed would be about 22 knots, but considerable advantage would be gained by smoother operation and higher speeds during rough weather.

Lummus Diversifies Services

In its half-century of operation, The Lummus Co. has designed, engineered, and constructed some 800 process installations—many of them for the petroleum industry. Recently the company published an illustrated brochure describing how its facilities serve the process industries throughout the world. The booklet lists some of the most recent facilities which have been added to the diversified projects of Lummus.

TI Forms British Company

Texas Instruments Inc., electronics and geophysics firm, has formed the Texas Instruments Ltd., a wholly owned subsidiary to manufacture and sell semi-conductor products in the United Kingdom. A plant is now under construction at Kempston Road, Bedford, 50 miles north of London.

Dudley Saward, a British citizen prominent in electronic and managerial circles, has been appointed managing director. During the war, as a group captain in the RAF, he was chief radar officer to the commander-in-chief, bomber command.

New Detergent Lets Tankers Switch Cargos

A new chemical detergent makes it possible for a tanker which carried a cargo of crude oil to switch quickly to a cargo of edible oil or even grain for its return trip. It's "Planisol," a granular detergent marketed by Dunham Chemical Co., subsidiary of National Cylinder Gas Co.

Instead of simply carrying water—as ballast—from Europe to the Middle East, a tanker will be able to carry a cargo of chemicals, for example, or other materials to India almost immediately after delivering a load of crude oil to Europe, according to G. R. Stewart, vice president of the chemical company. In order to carry double payloads on such "turnaround" trips, a ship's tanks will be cleansed by a hot-water solution of the new chemical applied by hose equipped with a spinning nozzle. The solution is recirculated through one tank after another. No scrubbing of the tanks is required, and the Planisol method is said to cut costs of tank cleaning as much as 60%.

New Tidewater Refinery Supervisors

Eleven supervisors at Tidewater Oil Co.'s Delaware Refinery, now nearing completion, Wilmington, Del., have been announced.

Those appointed were: William H. Bacon, group leader, knock testing; Everitt T. Chandler, Carl F. Lewis and James Jeffries Jr., general services shift supervisors; Arthur T. Dundas, chief estimator, engineering; Dr. Jack M. Gillette, group leader, spectroscopy; Andres J. Juhas, group leader, analytical section; Thomas J. Magner, senior engineering draftsman; James Victor McCool, supervisor of safety; Mansell S. Richards, oil scheduler, utilities oil dispatching and sulfur-recovery department; Aniello Vicedomini, group leader, physical testing. years, although no firm construction plans have been released.

$96 Million for Basic Chemicals from Oil

A total of $95,611,000 is being spent or planned on plants to make basic chemicals from crude oil and natural gas, according to Manufacturing Chemists Assn. in a report foreseeing $3.6 billion of spending by all chemical industry. The oil and gas chemicals figure includes $48,500,000 of spending planned; $18,050,000 under construction, and $29,061,000 completed in 1956.

40,000 B/D Refinery for Northwest

The Texas Co. will build a new 40,000 b/d integrated refinery near Anacortes, Wash. Engineering work on the refinery has already begun, and the plant is scheduled for completion by January 1959.

Du Pont to Expand Uramon Production

Expansion of production facilities for "Uramon" ammonia liquors at Du Pont's Belle Works in West Virginia, to be completed in 1959, is being accompanied by conversion of the plant's high-presure synthesis from coal to natural gas.

Du Pont, first in the United States to manufacture urea-ammoniating solutions for fertilizers, not only pioneered in the development of high-pressure techniques for producing ammonia by fixation of atmospheric nitrogen, but also in the conversion of ammonia to urea. The Belle Works, established in 1926, produces ammonia; chemical intermediates for nylon; urea for fertilizers, cattle feeds, medicinals and adhesives; hydrogenated oils and other industrial chemicals; automotive anti-freeze solutions; and intermediates for plastic resins.

US Delivers 90% of Europe's Needs

Frank M. Porter, president of the American Petroleum Institute, predicted recently that "within a short time it will be shown that Western Europe is receiving not approximately 80% of normal product needs, but something closer to 90%." Striking back at those who are "publicly impugning our motives and our methods, and are misrepresenting our achievements," Mr. Porter made it plain he feels "some people" apparently were using "alleged deficiencies in the oil-for-Europe program as a stick to beat the petroleum industry." He declared that Western Europe has been saved from its most serious fuel crisis in history by emergency action of unparalleled magnitude, and that individual oil companies accomplished the "largest and fastest shift in the distribution of any commodity ever achieved in peacetime—first through their own initiative and later through the operation of the Middle East Emergency Committee, at the request of, and under the supervision of, the federal government."

Mr. Porter also expressed grave concern over the recent "unwarranted and unsupportable attacks" on the petroleum industry, and said that recent hearings in Washington not only have confirmed the success of the oil-for-Europe program, but that each new report from domestic and overseas sources emphasizes it more.

THE END OF AN ERA: The last of General Petroleum Corp.'s wooden derricks in the field topples to earth. The 122-ft derrick was built in 1923. The well, Santa Fe 1-A, produced 909,200 bbl before it was abandoned on August 1, 1956. At one time General Petroleum had approximately 200 wooden derricks in the field. (General Petroleum Co. photo).

European Chemical Growth Outstrips USA

The growth of the chemically related industries in western Europe during the past four years has outstripped the proportional growth of their counterparts in the United States, it was reported at a joint meeting of the American Section, Societe des Ingenieurs Civils de France and the American Section, Societe de Chimie Industrielle of Paris, held at the French Institute, New York, by Dr. Robert S. Aries.

The average European chemical growth from 1953 until the Middle East crisis was 12% per year, compared with somewhat less than 10% in the USA. Average net profits after taxes of the publicly owned chemical-process European companies is about 6% of their sales, compared with about 9% for USA counterparts, according to Dr. Aries, who recently returned from a two months' survey trip.

Western Europe manufactured products based on USA licenses are estimated to sell for $1 billion annually, and provide about $30 million of annual income to USA companies. Processes have also been purchased from western Europe by North American companies at an increasing rate.

Gulf Withdrawal From Italy

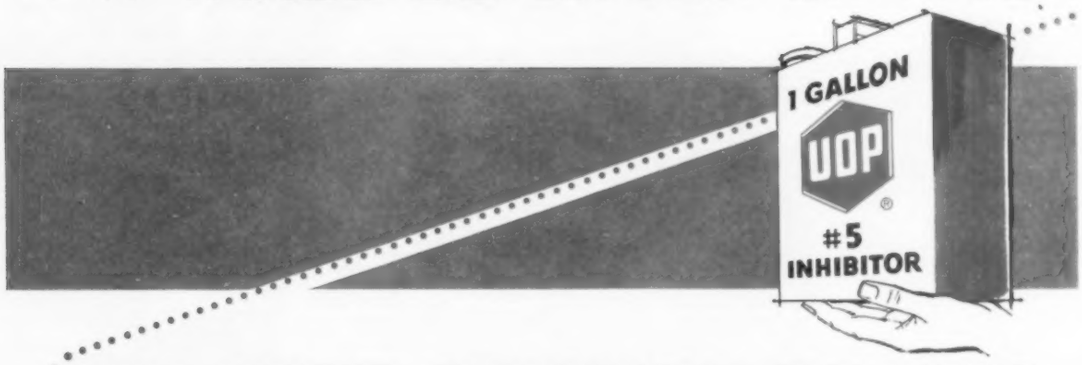
Simultaneous statements of Chairman C. W. Hamilton of Gulf Eastern, in London, and Nicolo Piguatelli Arahona of Gulf Italia, in Rome, indicate reluctant withdrawal of Gulf Italia from exploration on the mainland of Italy.

Upon publication of new Italian hydrocarbons law in September 1956, Gulf reserved its right to withdraw if examination proved such course wise in view of uneconomic provisions. Gulf Italia's position in Sicily remains unaffected where the regional law of 1950 makes private enterprise more attractive.

New laws published for oil exploration and development on Italy's continental shelf embody more generous provisions in view of greater difficultffiies and risks in under-water search. A single exploration permit may cover up to 240,000 acres, as against 120,000 onshore, and one company may obtain 960,000 acres offshore as against 720,000 onshore. Exploration permits may be for 6 years (two of 3 years each), with two 3-year extensions. Development concession is guaranteed, if oil is found, up to 21,600 acres (against 7,200 onshore), valid for 30 years and extendible for 10 (20 years on land). Lease rentals are one-third those by land law.

Gulf Italia continues development of its Ragusa field discovery; current production is 18,000 b/d (900,000 tons yearly). There will be a sharp increase when the £1.5 million 14-in. Ragusa-Augusta pipeline starts operation which, planned for January 28, has been delayed 10 days. Line connects Ragusa field with Raffineria Sciliana Olii Minerali at Augusta.

* IT TAKES SO LITTLE OF THIS



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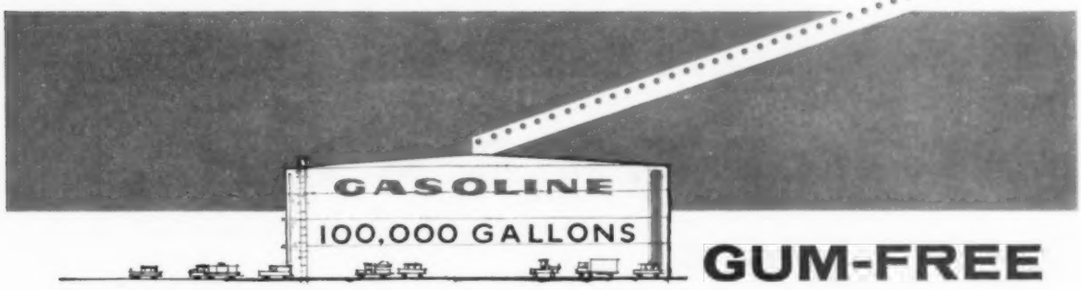

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The formation of gum in modern gasolines is the one universally recognized cause of engine manifold deposits. UOP Inhibitor #5 has been proven, by test and actual use, the best preventative for this. It's effective, too, in preventing the decomposition of TEL in stored gasolines.

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UOP #5 is one of a number of UOP inhibitors and additives available to the refining industry. If you have a protection or preservation problem for product or transport facilities consult us.

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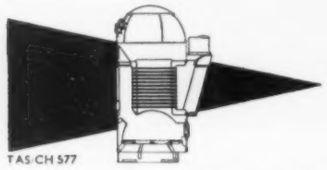
The heart of a Cochran boiler is the furnace, a dome of steel hot-pressed from a flat plate into a hemisphere without weld or seams; the absence of rivets enables it to withstand intense local heat, even such as is met when the boiler is oil-fired. The rivet holes in the furnace and ogee are drilled see illustration) whilst firmly held together with tack bolts. The tack holes, held in position by drifts through the holes previously drilled, are finally drilled out to size for riveting. Attention to detail is one of the reasons for the supremacy of the Cochran boiler.



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COCHRAN

Cochran & Co., Annan, Ltd., Annan, Dumfriesshire, Scotland, and at 34, Victoria Street, London, S.W.1

If it's a difficult non-ferrous casting—consult Birkett, Billington & Newton. On the right is an example of what they can do. It is one of a pair of housings for the driving shaft of an independently sprung wheel. To withstand severe shocks and stresses it was cast in high tensile manganese bronze and then precision-machined. Birkett, Billington & Newton have the facilities and knowledge to solve your non-ferrous casting problems—however difficult.

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CASTINGS FROM A FEW OUNCES TO 10 TONS..

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and associated equipment
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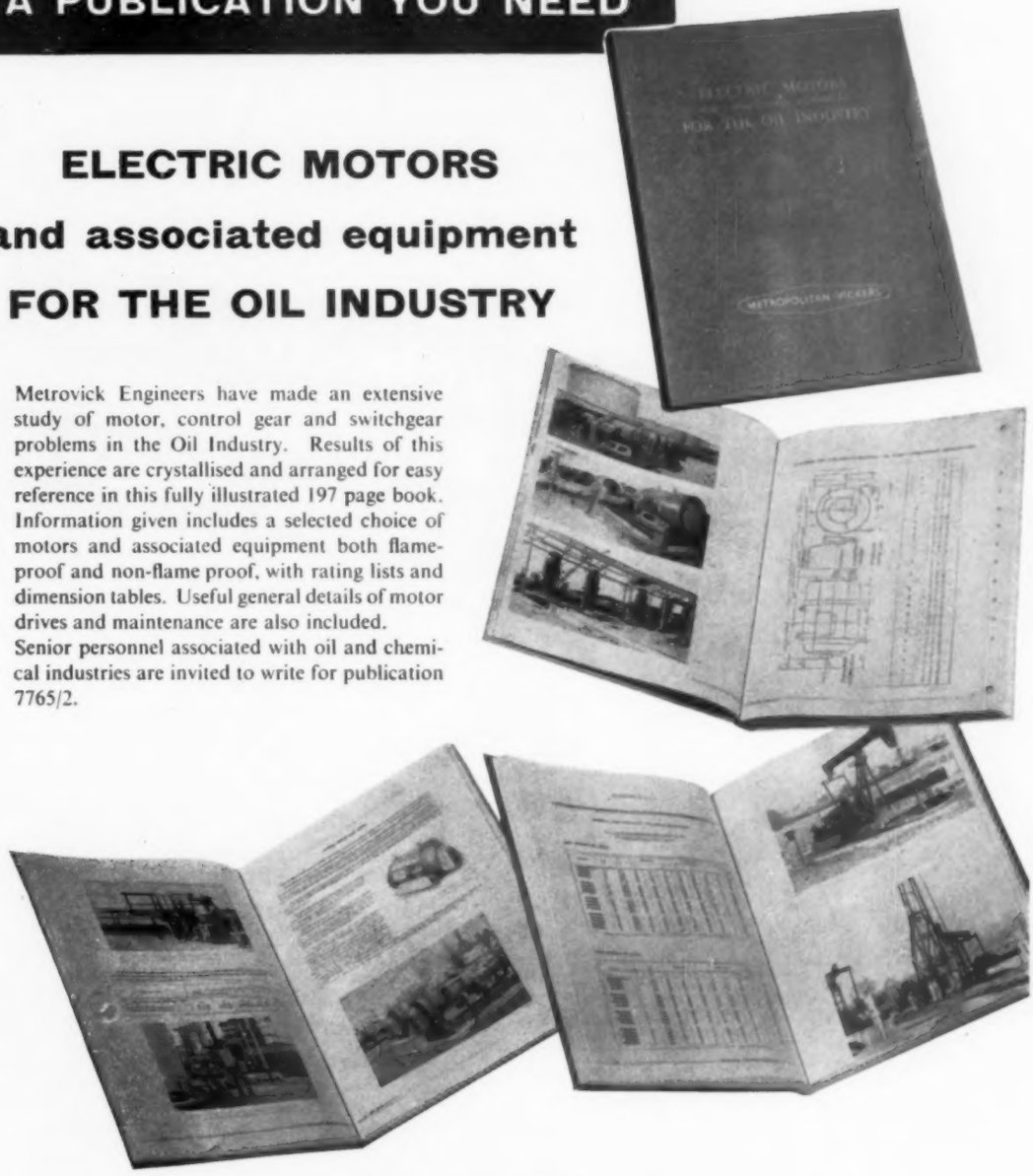
Metrovick Engineers have made an extensive study of motor, control gear and switchgear problems in the Oil Industry. Results of this experience are crystallised and arranged for easy reference in this fully illustrated 197 page book. Information given includes a selected choice of motors and associated equipment both flame-proof and non-flame proof, with rating lists and dimension tables. Useful general details of motor drives and maintenance are also included.
Senior personnel associated with oil and chemical industries are invited to write for publication 7765/2.



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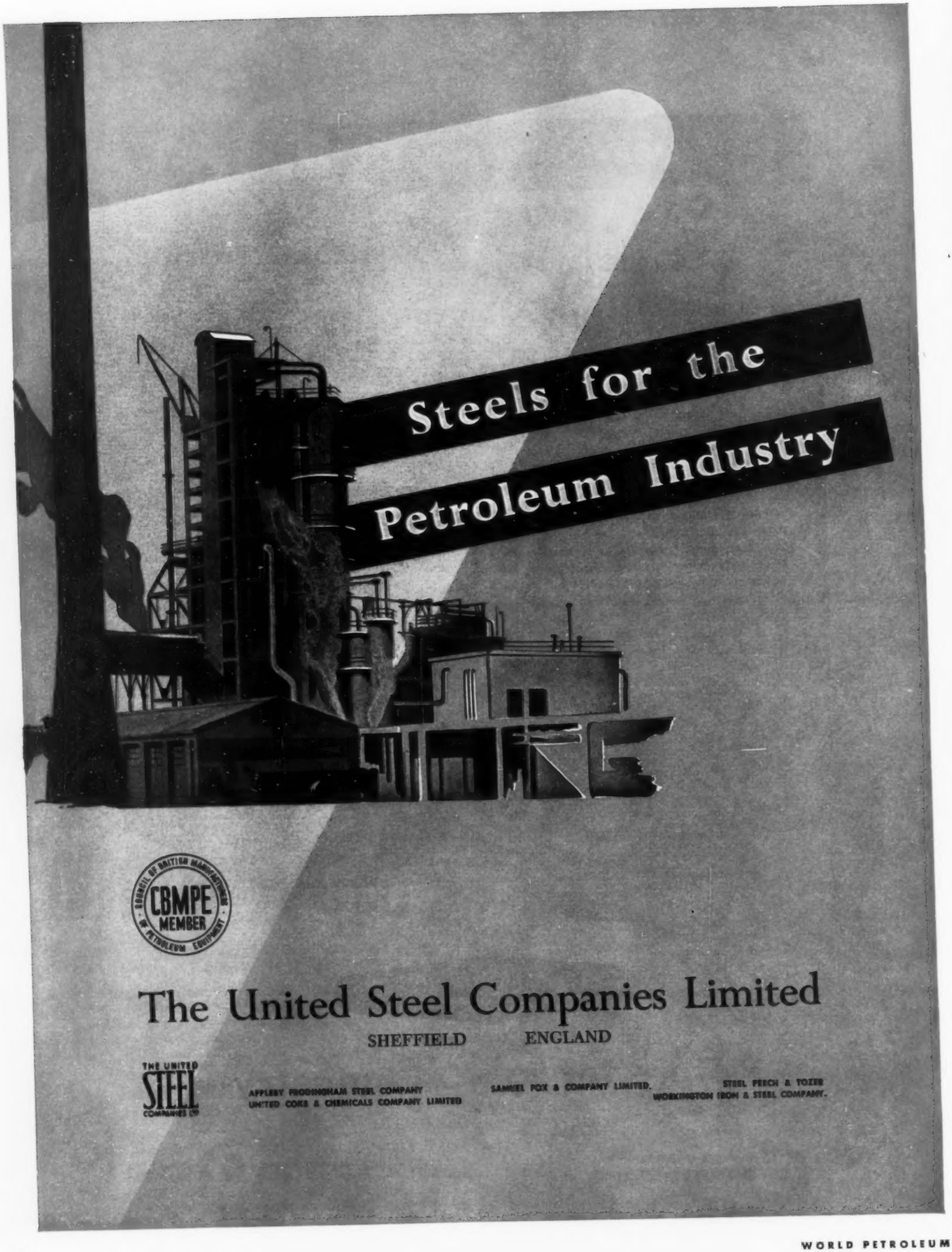
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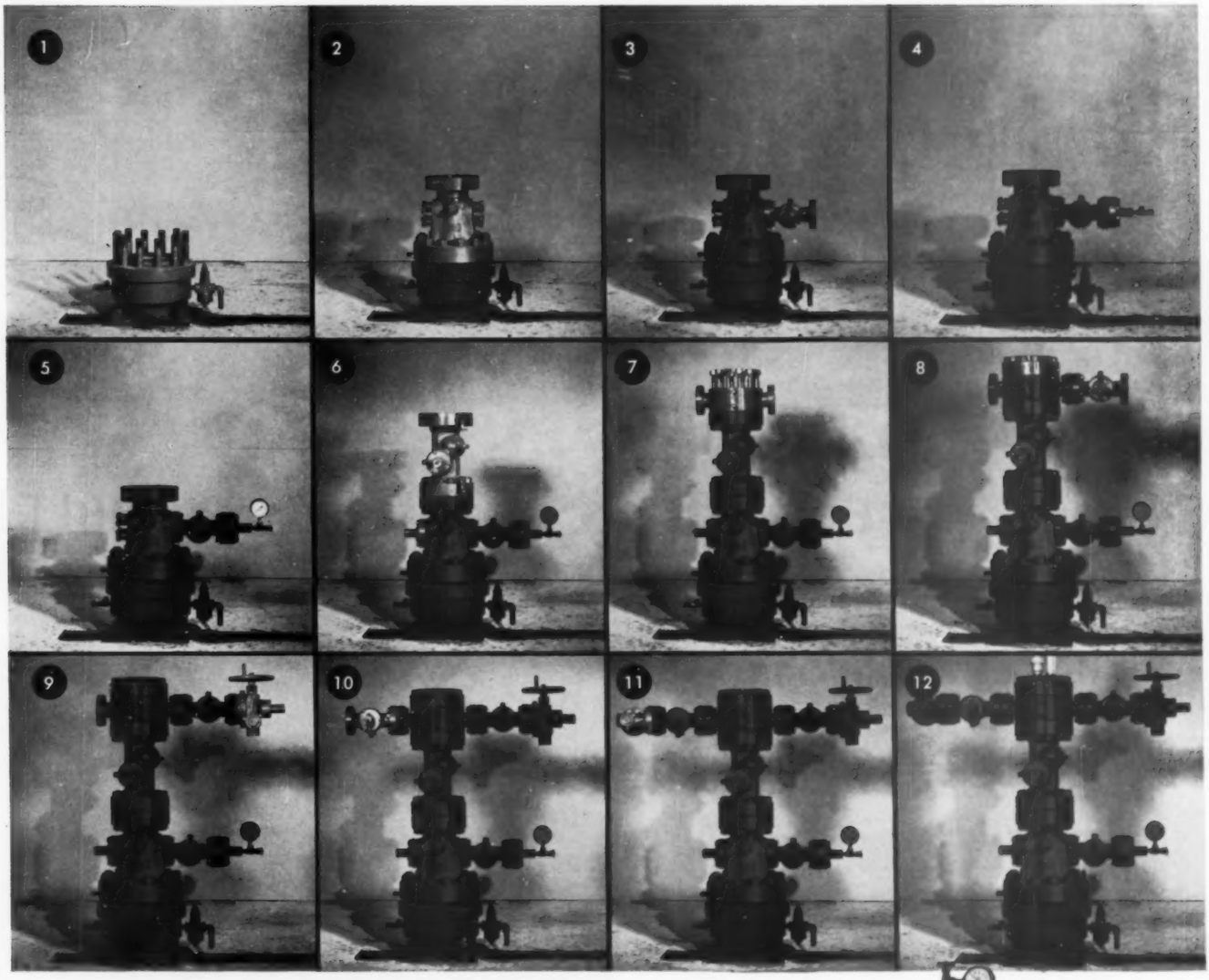
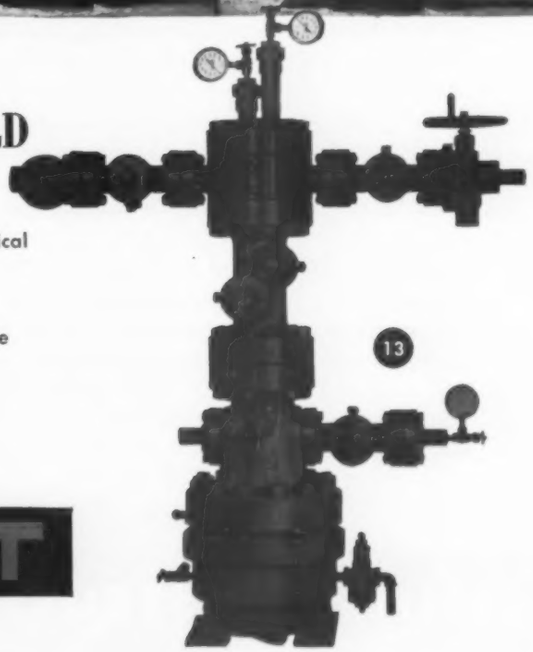


"STEP-BY-STEP STORY" of the BEST DUAL ASSEMBLY IN THE FIELD

From the first bolt to the last gauge, the dual tree shown above in the various stages of growth, represents the most practical and efficient dual well control equipment in the field.
It is an O-C-T Dual Tree, including the new and revolutionary O-C-T Universal Tubing Head.
Dual assemblies, pioneered by O-C-T and now improved to give you even greater versatility, answer long existing problems.
For deep or shallow multiple pay zones... if you make **any** kind of dual completion... make it O-C-T, the pioneer and leader in dual completion equipment.



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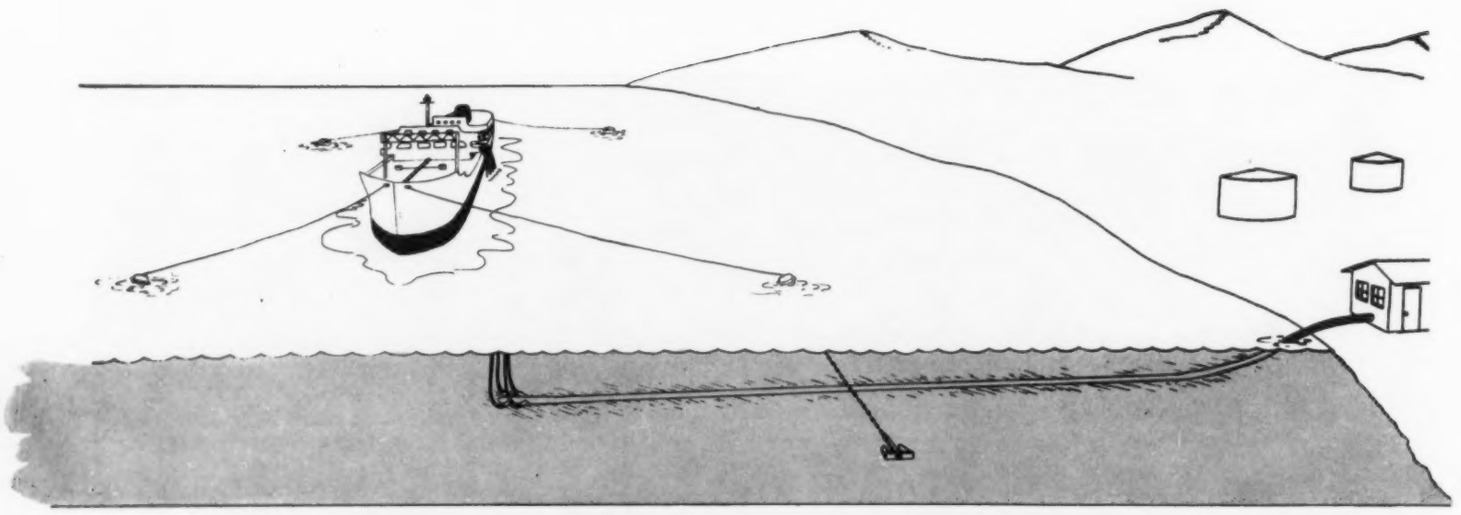


SOLVING THE SUPERTANKER PROBLEM

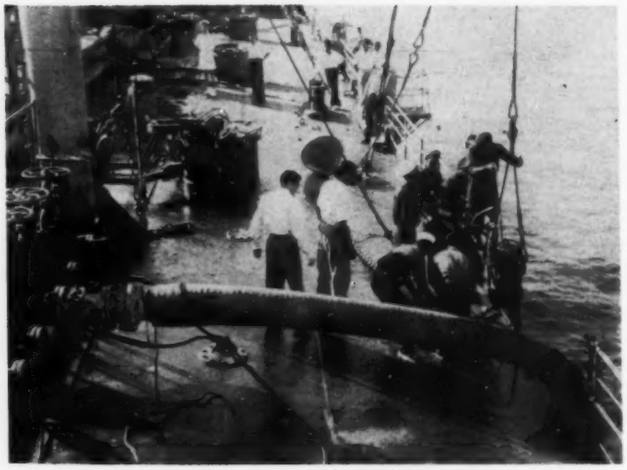
The most feasible solution to the harbor and anchorage problems presented by the coming 100,000 dwt supertanker lies in the utilization of sea-loading lines, terminating at depths in which any size tanker can maneuver freely under its own power.

Diagrammed above is a sea-loading system designed by the Collins Construction Co. All pipeline construction required for this system can be completed in less than six months under normal conditions.

In a fraction of the time, and at a fraction of the cost of harbor enlargement, sea-loading facilities designed to accommodate fully loaded supertankers of 100,000-ton capacity and larger can be provided in any navigable waters of the Free World.

The Collins Construction Co. has designed and engineered safe and economical permanent installations which have been proven in service. The costly, time consuming process of reducing draft for entry into shallow water ports by partial unloading can be completely eliminated.

Revolutionary techniques, patented methods, and specialized equipment enable Collins to maintain world leadership in the construction of submarine pipelines. Any one of these methods, or a special adaptation, may be the answer to *your* submarine pipline problem.



One hose already connected, another sea-loading hose is being brought on deck as the "Tagelus" of London, a T2 type 38,000 dwt tanker, prepares to begin pumping operations through a sea-loading line installed by Collins in the Bay of Bombay for the Bombay Port Trust.

Employing similar installation techniques, Collins has also developed a method whereby existing shallow water sea-loading lines can be extended to greater depths to keep pace with the increasing proportions of modern tankers. Extension of present sea-loading lines can be done more economically than designing and constructing entirely new pipelines.

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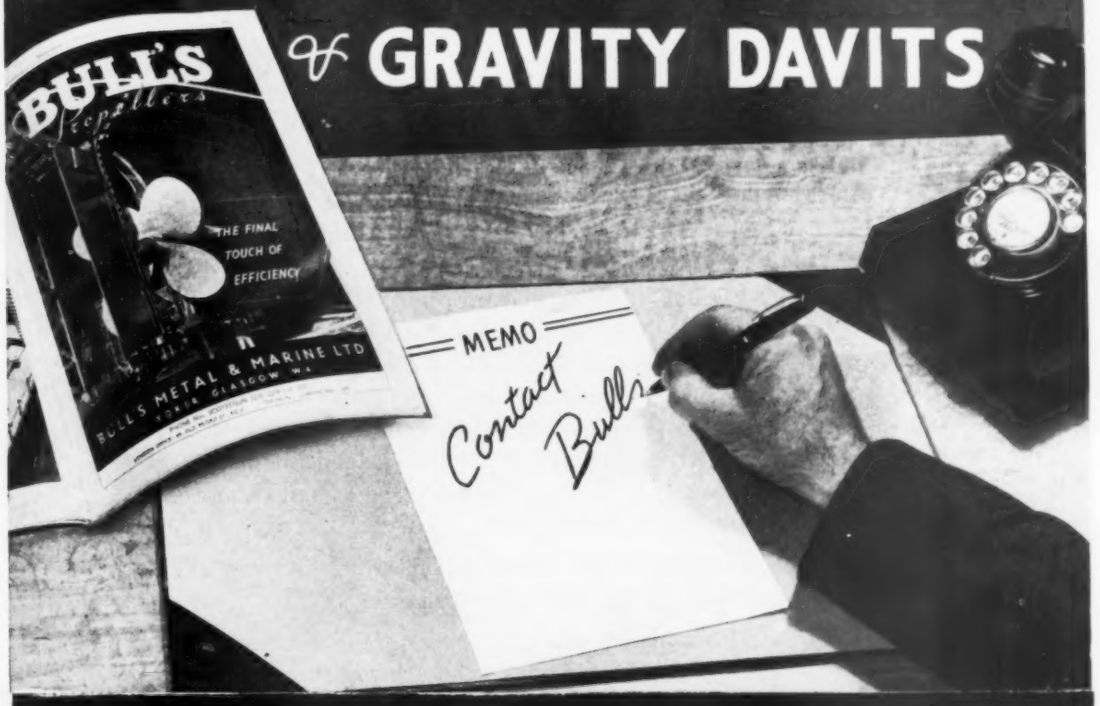

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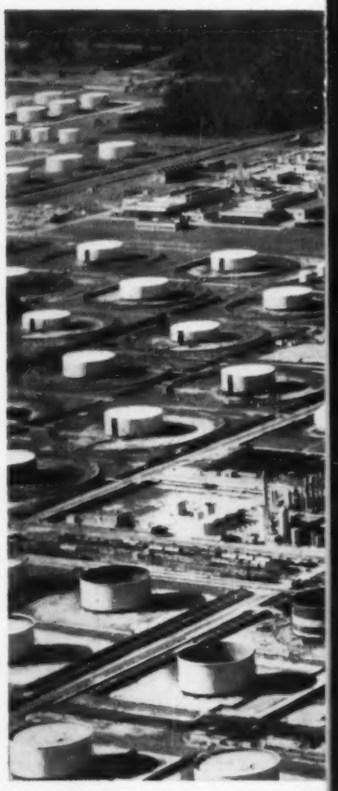

Here at Lake Charles, Louisiana, Petroleum Chemicals, Inc. will expand its petrochemical facilities with the addition of a butyl rubber plant — to be built by Foster Wheeler.

With an initial capacity of 30,000 tons per year, this $17,000,000 plant will be the first one built since the war and its operation will increase the country's total butyl rubber capacity by about one third. This new plant will obtain its raw materials from the hydrocarbon streams available at the Lake Charles refineries of Cities Service and Continental Oil Companies, joint owners of Petroleum Chemicals, Inc.

Foster Wheeler is also building a 300 ton/day ammonia synthesis plant at the same site.

This is another example of how Foster Wheeler's design, engineering and construction experience is helping to meet the exact requirements of petroleum, chemical and petrochemical processing plants the world over.

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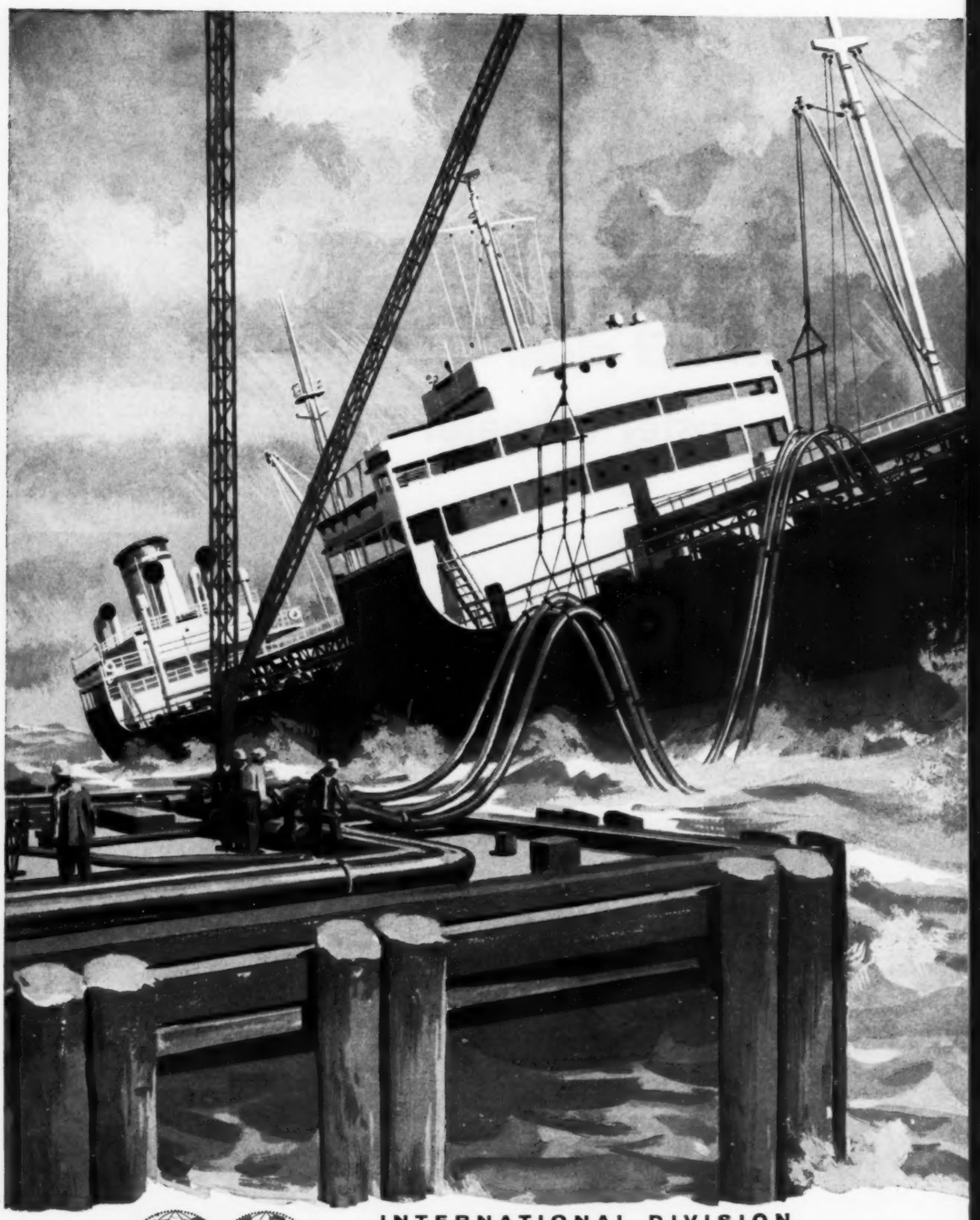

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Building better loading hose to feed storm-tossed tankers is but one of the ways that Hewitt-Robins is helping industry through better bulk materials handling equipment. For information about how Hewitt-Robins products and services can help your organization, contact one of our foreign subsidiaries or write to our Export Department in the U.S.A.

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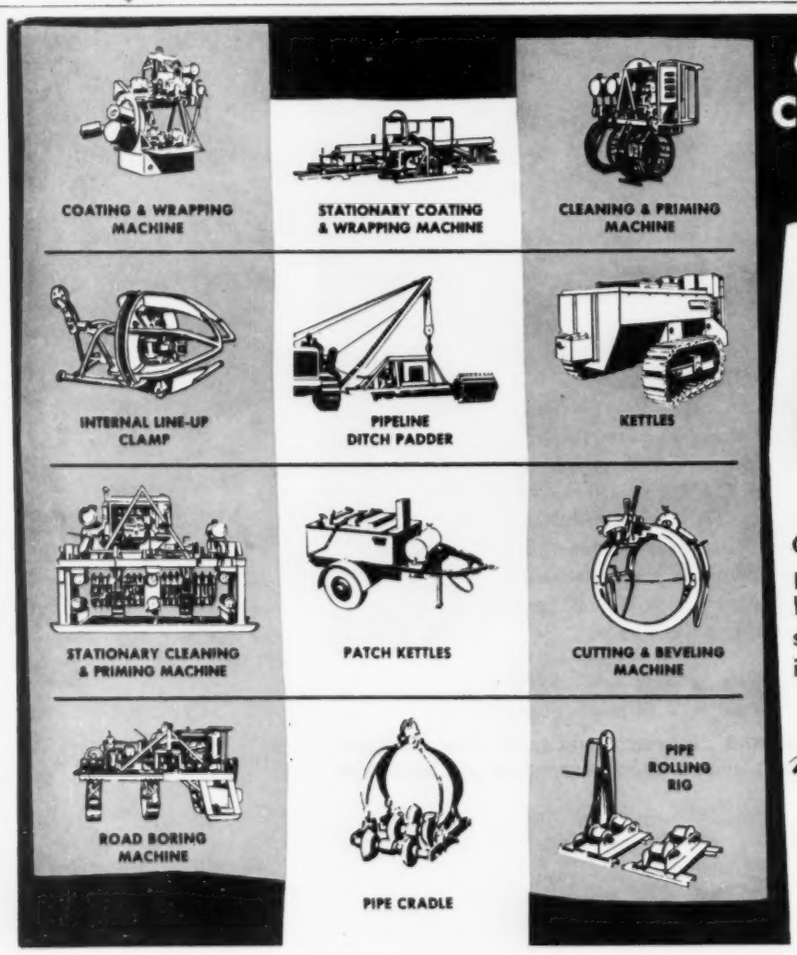

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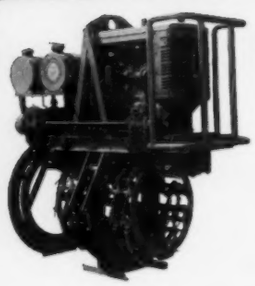

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Also can be used with stationary base for yard work. Handles pipe up to 36".

Counter rotating heads assure faster cleaning and priming . . . prevent pipe from turning and give better cleaning job. These Crose machines are specifically designed for faster, trouble-free service on the line.

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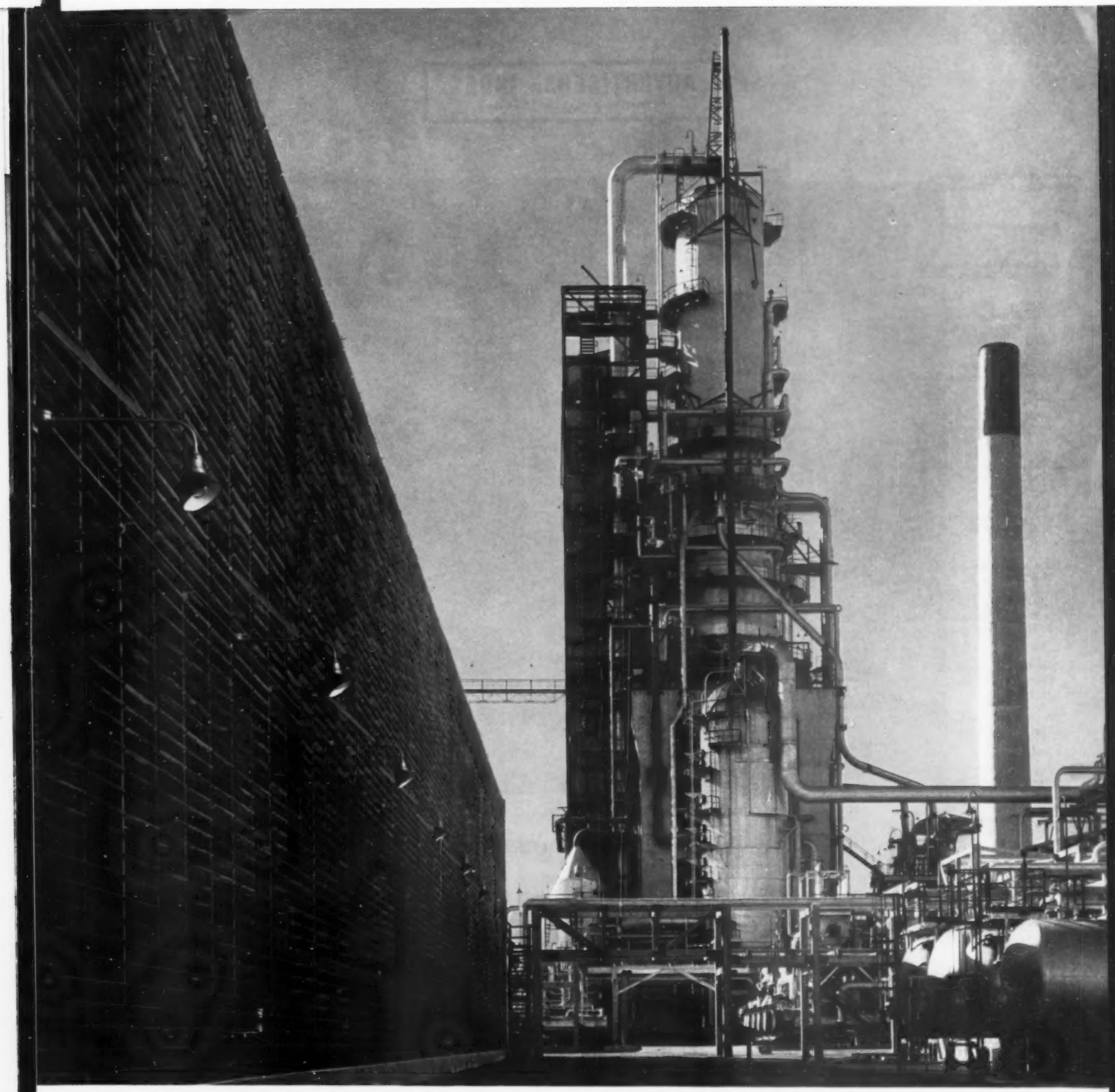

BROADER WINGS FOR THE FLYING A

Tidewater Oil Company recently completed the first phase of a major expansion program which gave its Avon Refinery, on San Francisco Bay, both increased output and the ability to manufacture new and improved products under the familiar Flying A banner. Total capacity was raised substantially. Among new facilities is a 42,000 barrel Fluid Coking Unit, the world's largest.

Bechtel furnished design, procurement and construction . . . an integrated project under single responsibility.

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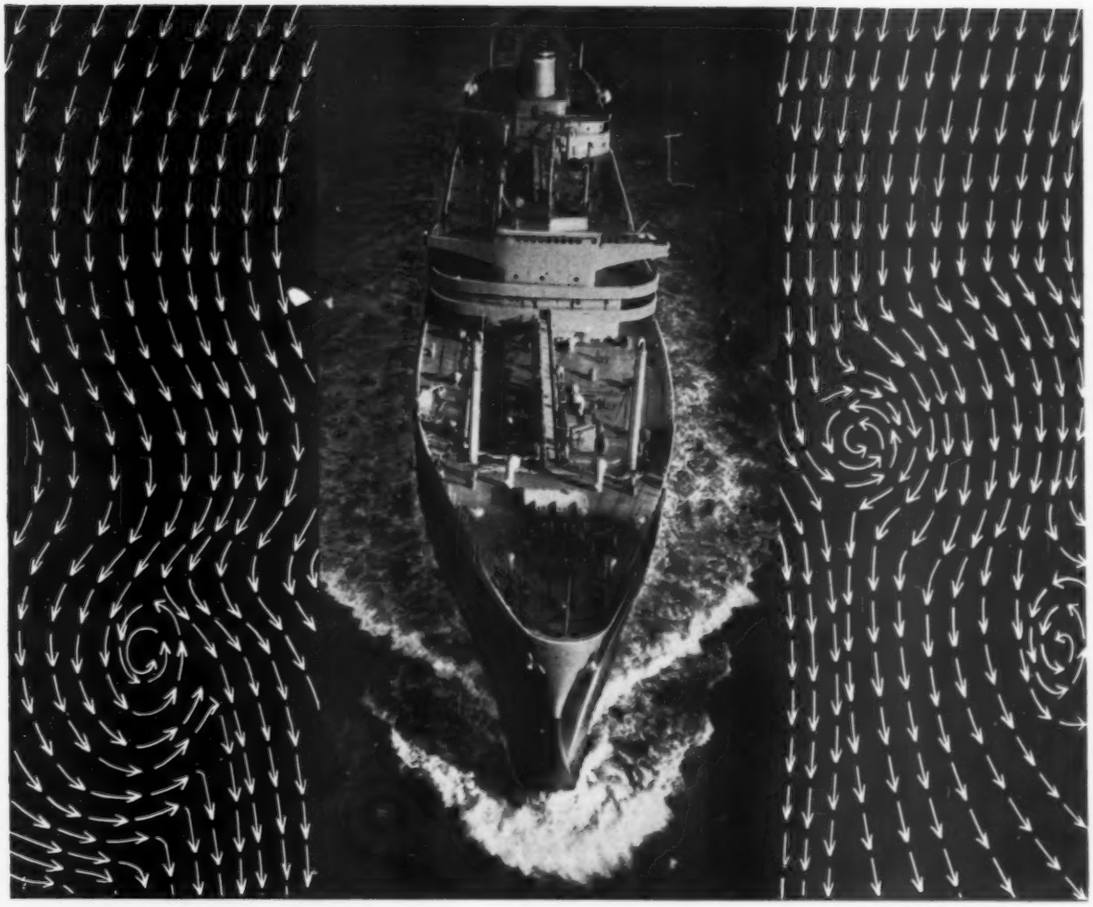

"HEADWAY"... PETROLEUM and TANKERS

Construction of the Maumee—first of the new T-5 tankers to report for duty in the Military Sea Transportation Service—carries on the tradition of Sun Ship service to marine transportation of petroleum.

That tradition began forty years ago with the first ship launched from Sun's ways —the 80,000-barrel tanker Chester Sun. In the four decades since that launching, approximately 400 tankers built by Sun have proved their worth in peace and war. Among them was the first all-welded sea-going tanker. Those years have brought, too, an increase in the size of tankers; capacities up to 700,000 barrels are built today.

Sun Ship facilities have grown steadily with the industry . . . serve many companies both in construction of tankers and in construction of land facilities. Sun will continue to hold that pace . . . to maintain its role in service of the industry which means so much to America . . . and to the world.

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SHIPBUILDING & DRY DOCK COMPANY

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Below right : Kent Oil Refinery, Isle of Grain.

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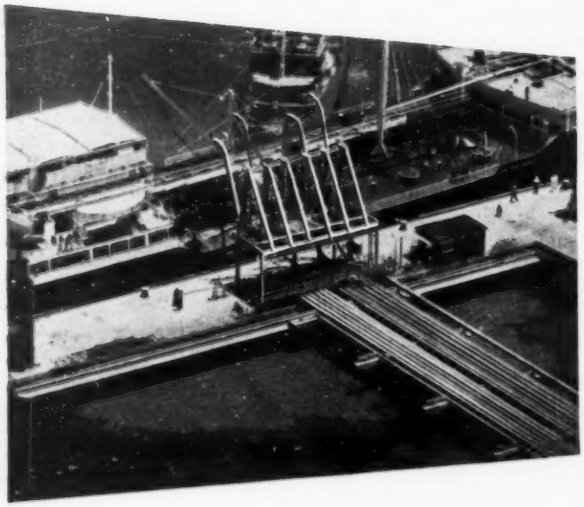
Saves Hose Costs, Labour and Demurrage charges, at many of the World's Refineries, Oil Storage Depots and Docks



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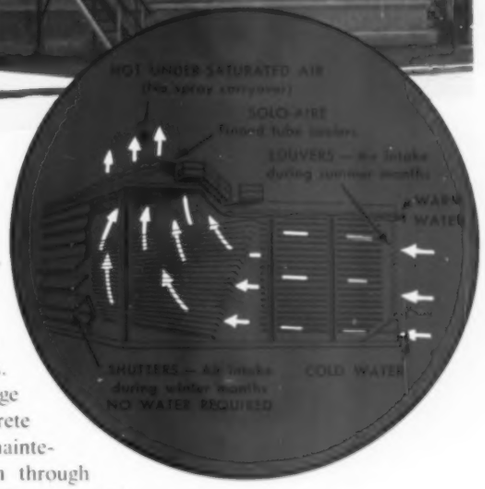

Where quantity or quality of water is low, and ambient air temperatures too high to permit direct cooling with air, process plant designers find the modern solution in Combin-aire. In addition to large savings through minimizing water consumption and eliminating water treatment, Combin-aires incorporate many other advantages.

The Combin-aire pictured above, installed in a large gas processing plant in northern Mexico, is of concrete construction, eliminating fire hazard and minimizing maintenance. As shown in the cut-away drawing, air is drawn through cooled water by fans located on top of the structure. The air, precooled and washed free of solids by the water, flows across the finned tube coolers, and leaves the top of the Combin-aire at elevated temperature under-saturated with water vapor. Mist carryover, condensation from effluent air, and air recirculation are thus eliminated. Combin-aires are installed adjacent to process equipment, minimizing piping and concentrating operating area.

In winter, air flows directly to the Solo-aire finned coolers, water circulation being unnecessary. Where water is required for shell and tube units or atmospheric sections, such water may also be cooled in the Combin-aire unit, eliminating the conventional cooling tower.

In addition to Combin-aire units, Hudson manufactures water cooling towers, air-cooled and water-cooled coolers and condensers, and is experienced in plant layout, piping, and water treatment. We shall be glad to assist prospective plant owners in making overall comparisons of first costs and operating costs for complete cooling systems using various combinations of equipment.

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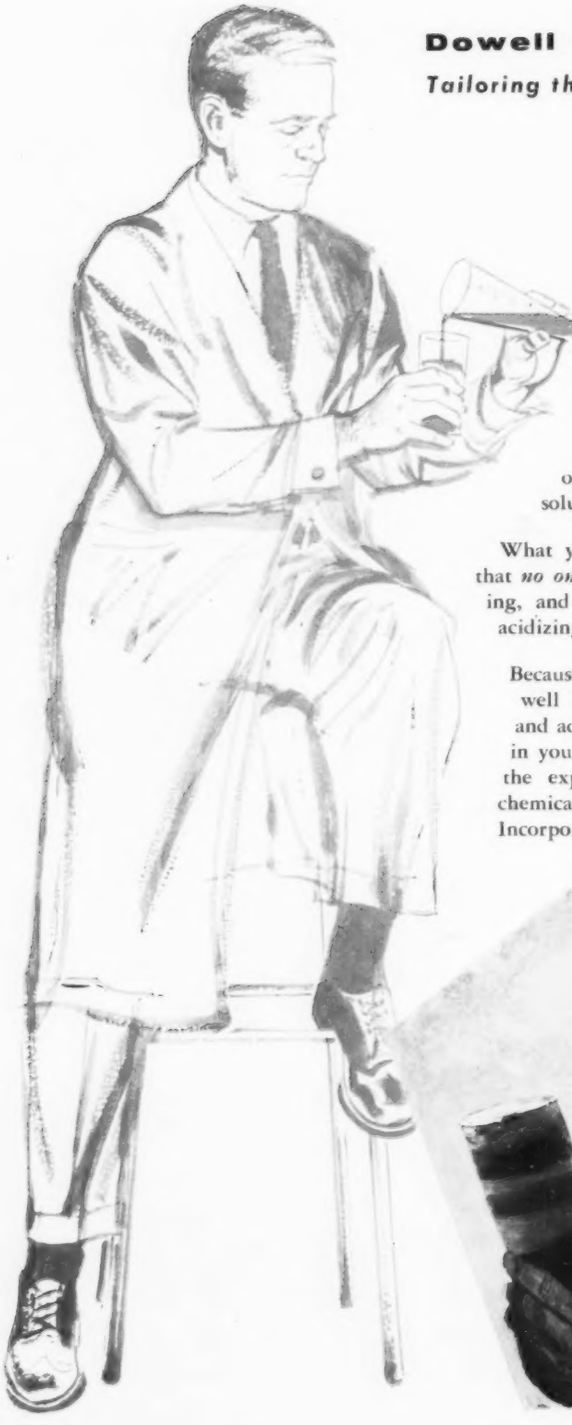

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owell Acidizing Begins Here . . .

iloring the Right Acid Combination for Your Well

New chemicals to improve the results of acidizing treatments have been coming from Dowell research since 1932. And during that time Dowell service engineers have earned the practical knowledge that comes from long experience in doing a job well. From the moment the Dowell engineer begins working with you, you have the entire Dowell organization bending its efforts toward the solution of your problem.

What you get from Dowell, then, is the assurance that *no one* has had more experience in oil well acidizing, and that *no one* has a more complete line of acidizing chemicals.

Because of this background, Dowell can approach every well individually. The proper combination of acids and addition agents is tailored to give maximum results in your particular well. Dowell has the years of service, the experienced man power, and the wide range of chemicals needed to give you the best possible job. Dowell Incorporated, Tulsa 1, Oklahoma.

OWELL

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